

SECTION 01453
CODE REQUIRED SPECIAL INSPECTIONS AND PROCEDURES

This section covers code (see Article 1.5.A) required Special Tests and Inspections. The Design Professional in Responsible Charge (DPRC, See Article 1.5.C) shall prepare a Statement of Special Inspections in accordance with the Massachusetts State Building Code which shall be included in the Contract Documents in another location. The Authority shall require the Design Professional to procure Special Inspections under a separate work order. The Design Professional in Responsible Charge shall edit this Section as required to remove articles not pertinent to the Project Specific Requirements.

PART 1 - GENERAL

1.1 SUMMARY

- A.** Section includes administrative and procedural requirements for Special Inspection and Testing Procedures.
- B.** Special Inspection and Testing services as specified in this Section are required by Code for verification of the Contractor's compliance with the requirements of the Contract Documents. These services do not relieve Contractor of its responsibilities to provide its own quality control and for compliance with the Contract Document requirements.
- C.** Work and services described in this Section are the responsibility of the Design Professional in Responsible Charge and shall not be included for payment to the Contractor, unless noted otherwise.
- D.** Inspection and testing services described in this Section are to be performed by a third party, independent of the Contractor, with the results reported directly to the MBTA or MBTA's representative.

1.2 SECTION INCLUDES

- A. Code-required special inspections.
- B. Testing services incidental to special inspections.
- C. Submittals.
- D. Manufacturers' field services.
- E. Fabricators' field services.

1.3 RELATED REQUIREMENTS

- A. Supplemental Information: Soil investigation data.
- B. Document 00 700FB - General Conditions: Inspections and approvals required by public authorities.
- C. Section 01 020FB - Allowances: Allowance for payment of testing and inspection services.
- D. Section 01 300FB - Submittals: Submittal procedures.
- E. Section 01 400FB - Quality Assurance.

1.4 ABBREVIATIONS AND ACRONYMS

- A. ACI: American Concrete Institute
- B. API: American Petroleum Institute
- C. AHJ: Authority Having Jurisdiction
- D. AISC: American Institute of Steel Construction
- E. ASCE: American Society of Civil Engineers
- F. ASTM: American Society for Testing and Materials
- G. AWCI: Association of the Wall and Ceiling Industry
- H. AWS: American Welding Society
- I. DPRC: Design Professional in Responsible Charge
- J. FHWA: Federal Highway Administration
- K. IBC: International Building Code
- L. ICC: International Code Council
- M. MSBC: Massachusetts State Building Code
- N. NIST: National Institute of Standards and Technology
- O. PTI: Post Tensioning Institute
- P. RCSC: Research Council on Structural Connections
- Q. SDI: Steel Deck Institute
- R. SJI: Steel Joist Institute
- S. TMS: The Masonry Society

1.5 DEFINITIONS

- A. Code or Building Code: International Building Code (IBC) with Massachusetts State Building Code (MSBC) Amendments, most recent edition of the MSBC, including all applicable amendments and supplements and specifically, Chapter 17 - Special Inspections and Tests. In the event of a conflict between the provisions contained in the IBC and the MSBC, the MSBC shall govern.
- B. Authority Having Jurisdiction (AHJ): An organization, office or individual officially empowered to enforce the building, fire and life safety code requirements of the permitting jurisdiction in which the Project is located. Unless otherwise provided, only new and first quality materials conforming to the requirements of the Specifications and approved by the Owner shall be used in the work, except for material used by the Contractor for his convenience and which is not to be permanently incorporated in the work.
- C. Design Professional in Responsible Charge (DPRC): Registered or licensed design professional with contractual responsibility and authority over all required disciplines to prepare and coordinate a complete and comprehensive set of construction documents for the project.

- D. Special Inspection Agency: An independent firm approved to perform inspections of the type specified in this Section on constructed elements.
- E. Testing Agency: An independent agency approved to perform tests to the relevant standard(s) as specified in this Section on products, materials or assemblies.
- F. Special Inspector: A qualified person employed or retained by an approved agency or a designated representative of the DPRC, as having the competence necessary to inspect a type of construction requiring special inspection.
- G. Special Inspections:
 - 1. Special inspections are inspections and testing of materials, installation, fabrication, erection or placement of components and connections mandated by the AHJ that also require special expertise to ensure compliance with the approved Contract Documents and the referenced standards.
 - 2. Special inspections are separate from and independent of tests and inspections conducted by MBTA or Contractor for the purposes of quality assurance and contract administration.
- H. Contractor: Entity or firm awarded the project and responsible to perform the work defined by the contract documents.

1.6 REFERENCE STANDARDS

- A. Reference standards shall be the edition listed in the currently adopted version of the MSBC.
- B. ACI 318 - Building Code Requirements for Structural Concrete.
- C. AISC 341 - Seismic Provisions for Structural Steel Buildings.
- D. AISC 360 - Specification for Structural Steel Buildings.
- E. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures.
- F. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
- G. ASTM A706/A706M - Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement.
- H. ASTM C29 - Standard Test Method for Bulk Density ("Unit Weight") and Voids in Aggregate.
- I. ASTM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field.

- J. ASTM C172/C172M - Standard Practice for Sampling Freshly Mixed Concrete.
- K. ASTM C495 - Standard Test Method for Compressive Strength of Lightweight Insulating Concrete.
- L. ASTM C796 - Standard Test Method for Foaming Agents for Use in Producing Cellular Concrete Using Preformed Foam.
- M. ASTM D1143 - Standard Test Methods for Deep Foundation Elements Under Static Axial Compressive Load.
- N. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort.
- O. ASTM D3689 - Standard Test Methods for Deep Foundation Elements Under Static Axial Tensile Load.
- P. ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
- Q. ASTM D3966 - Standard Test Methods for Deep Foundation Elements Under Static Lateral Load.
- R. ASTM D4253 - Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
- S. ASTM D4254 - Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
- T. ASTM D4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- U. ASTM D4945 - Standard Test Method for High-Strain Dynamic Testing of Deep Foundations.
- V. ASTM D6913 - Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis.
- W. ASTM D7383 - Standard Test Methods for Axial Rapid Load (Compressive Force Pulse) Testing of Deep Foundations.
- X. ASTM D8169 - Standard Test Methods for Deep Foundations Under Bi-Directional Static Axial Compressive Load.
- Y. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection.
- Z. ASTM E543 - Standard Specification for Agencies Performing Nondestructive Testing.
- AA. ASTM E605/E605M - Standard Test Methods for Thickness and Density of Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members.

- BB. ASTM E736/E736M - Standard Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members.
- CC. ASTM E2174 - Standard Practice for On-Site Inspection of Installed Firestop Systems.
- DD. ASTM E2393 - Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers.
- EE. ASTM E2570/E2570M - Standard Test Methods for Evaluating Water-Resistive Barrier (WRB) Coatings Used Under Exterior Insulation and Finish Systems (EIFS) or EIFS with Drainage.
- FF. AWCI 117 - Technical Manual 12-B; Standard Practice for the Testing and Inspection of Field Applied Thin Film Intumescent Fire-Resistive Materials; an Annotated Guide.
- GG. AWS D1.1/D1.1M - Structural Welding Code - Steel.
- HH. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel.
- II. AWS D1.4/D1.4M - Structural Welding Code - Steel Reinforcing Bars.
- JJ. ICC (IBC) - International Building Code.
- KK. RCSC - Specification for Structural Joints Using High Strength Bolts.
- LL. SDI (QA/QC) - Standard for Quality Control and Quality Assurance for Installation of Steel Deck.
- MM.SJI 100 - Standard Specifications for K-Series, LH-Series, and DLH-Series Open Web Steel Joists, and for Joist Girders.
- NN. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures.

1.7 SUBMITTALS

- A. See Section 01300FB - SUBMITTALS, for submittal procedures.
- B. Report Distribution: Submit at least four copies of each report; one to the DPRC, one to MBTA, one to the AHJ, and one to the Contractor.
- C. From Special Inspection Agencies
 - 1. Qualifications: Prior to the start of work, each Special Inspection Agency is required to:
 - a. Submit agency name, address, and telephone number, names of full time Professional Engineer and responsible officer.
 - b. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.

- c. Submit certification that the Special Inspection Agency is acceptable to AHJ.
 - d. Be independent from the contractor responsible for the work being inspected. Each Agency shall disclose to MBTA and the DPRC possible conflicts of interest.
- 2. Special Inspection and Testing Reports: After each special inspection or test, submit reports.
 - a. Include as a minimum the following information, and any additional information required elsewhere in this Specification:
 - 1) Date issued.
 - 2) Project title and number.
 - 3) Name of Special Inspector and certification credentials as applicable.
 - 4) Date and time of special inspection or test.
 - 5) Identification of product and specifications section.
 - 6) Location within the Project.
 - 7) Type and extent of special inspection or test.
 - 8) Results of special inspection or test.
 - 9) Compliance with Contract Documents.
 - b. Final Special Inspection Report: Document special inspections and tests and correction of discrepancies prior to the advancement of the work to conceal tested and inspected items and prior to occupancy.
- 3. Certificates: When specified in individual special inspection requirements, Special Inspector shall submit certifications submitted by the Contractor and approved by the DPRC, to the DPRC and AHJ, in quantities specified for Product Data.
 - a. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
 - b. Certificates may be recent or previous test results on material or product but must be acceptable to the DPRC and AHJ.

D. From Testing Agencies

- 1. Qualifications: Prior to the start of work, each Testing Agency is required to:

- a. Submit agency name, address, and telephone number, and names of full time Professional Engineer and responsible officer.
 - b. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
 - c. Submit certification that the Testing Agency is acceptable to AHJ.
 - d. Be independent from the contractor responsible for the work being tested. Each Agency shall disclose to MBTA and the DPRC possible conflicts of interest.
 2. Test Reports: After each test or inspection, submit reports with seven calendar days unless noted otherwise.
 - a. Include:
 - 1) Date issued.
 - 2) Project title and number.
 - 3) Name of Inspector and certification credentials as applicable.
 - 4) Date and time of sampling or inspection.
 - 5) Identification of product and specifications section.
 - 6) Location within the Project.
 - 7) Type and extent of test or inspection.
 - 8) Results of test or inspection.
 - 9) Compliance with Contract Documents.
- E. Smoke Control Testing Agencies Qualifications: Prior to the start of work, each Testing Agency is required to:
1. Submit agency name, address, and telephone number, and names of full time Professional Engineer and responsible officer.
 2. Submit documentary evidence that the Smoke Control Testing Agency has applicable credentials and documented experience in fire protection engineering, mechanical engineering, and HVAC air balancing.
 3. Submit certification that the Smoke Control Testing Agency is acceptable to AHJ.
- F. Manufacturer

1. Qualification Statement: Manufacturer is required to submit documentation of manufacturing capability and quality control procedures in accordance with the project technical specifications. Include documentation of AHJ approval of manufactured components in accordance with the project technical specifications.
2. Submit qualifications of field observer to the DPRC 30 days in advance of required observations.
 - a. Observer subject to approval of the DPRC.
 - b. Observer subject to approval of MBTA.
3. Manufacturer's Field Reports: Submit reports to the DPRC and AHJ.
 - a. Submit report within 30 days of observation to the DPRC for information.
 - b. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in Contract Documents.

G. Fabricator

1. Qualification Statement: Fabricator is required to submit documentation of fabrication facilities and methods as well as quality control procedures in accordance with the project technical specifications. Include documentation of AHJ approval of fabricated components in accordance with the project technical specifications.
2. Fabricator Special Inspection Reports: After each special inspection of fabricated items at the Fabricator's facility, submit reports.
 - a. Include:
 - 1) Date issued.
 - 2) Project title and number.
 - 3) Name of Special Inspector and certification credentials as applicable.
 - 4) Date and time of special inspection.
 - 5) Identification of fabricated item and specification section.
 - 6) Location within the Project.
 - 7) Results of special inspection.
 - 8) Verification of fabrication and quality control procedures.
 - 9) Compliance with Contract Documents.
 - 10) Compliance with referenced standard(s).

3. Submit qualifications of field observer to the DPRC 30 days in advance of required observations.
 - a. Observer subject to approval of the DPRC.
 - b. Observer subject to approval of MBTA.
4. Fabricator's Field Reports: Submit reports to the DPRC and AHJ.
 - a. Submit report within 30 days of observation to the DPRC for information.
 - b. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in Contract Documents.

1.8 SPECIAL INSPECTION AGENCIES

- A. The DPRC shall employ services of independent Special Inspection Agencies to perform inspections and associated testing and sampling in accordance with ASTM E329 and required by the building code.
- B. The Special Inspection Agencies may employ and pay for services of independent testing agencies to perform testing and sampling associated with special inspections and required by the building code.

PART 2 - PRODUCTS (not used)

PART 3 - EXECUTION

3.1 DPRC DUTIES AND RESPONSIBILITIES

- A. Regarding the requirements of this Section, the DPRC shall:
 1. Procure services required for special inspections and testing.
 2. Review reports submitted by the Special Inspector(s) and Testing Agency(ies).
 3. Respond to Special Inspection reports or Tests of uncorrected or noncomplying items and approve remedial measures.
 4. Provide a Final Report of Special Inspections and Tests to the AHJ.

3.2 SPECIAL INSPECTION AGENCIES DUTIES AND RESPONSIBILITIES

- A. Special Inspection Agencies shall:
 1. Verify samples submitted by Contractor comply with the referenced standards and the approved Contract Documents.
 2. Provide qualified personnel at site. Cooperate with the DPRC and Contractor in performance of services.
 3. Perform specified sampling and testing of products in accordance with specified reference standards.

4. Ascertain compliance of materials, products and workmanship with requirements of Contract Documents.
 5. Promptly notify the DPRC, MBTA on-site representative, and Contractor of observed irregularities or non-compliance of work or products.
 6. Perform additional tests and inspections required by the DPRC.
 7. Attend preconstruction meetings and progress meetings.
 8. Submit reports of all tests or inspections specified.
- B. Limits on Special Inspection Agencies Authority:
1. Agencies may not release, revoke, alter, or enlarge on requirements of Contract Documents.
 2. Agencies may not approve or accept any portion of the work.
 3. Agencies may not assume any duties of Contractor.
 4. Agencies have no authority to stop the work.
- C. Re-testing and/or re-inspection required because of non-compliance with specified requirements shall be performed by the same agencies on instructions by the DPRC.
- D. Costs incurred due to re-testing and/or re-inspection required because of non-compliance with specified requirements shall be reimbursed to the MBTA by the Contractor.

3.3 TESTING AGENCIES DUTIES AND RESPONSIBILITIES

- A. Testing Agencies Duties:
1. Test samples submitted by Contractor.
 2. Provide qualified personnel at site. Cooperate with the DPRC and Contractor in performance of services.
 3. Perform specified sampling and testing of products in accordance with specified standards.
 4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
 5. Promptly notify the DPRC and Contractor of observed irregularities or non-compliance of work or products.
 6. Perform additional tests and inspections required by the DPRC.
 7. Submit reports of all tests or inspections specified.
- B. Limits on Testing Agencies Authority:
1. Agencies may not release, revoke, alter, or enlarge on requirements of Contract Documents.

2. Agencies may not approve or accept any portion of the work.
3. Agencies may not assume any duties of Contractor.
4. Agencies have no authority to stop the work.
- C. On instructions by the DPRC, perform re-testing required because of non-compliance with specified requirements, using the same agencies.
- D. Re-testing required because of non-compliance with specified requirements shall be paid for by the Contractor.

3.4 CONTRACTOR DUTIES AND RESPONSIBILITIES

A. Contractor Responsibilities, General:

1. Deliver to Special Inspection Agencies, or designee, at designated location, adequate samples of materials for special inspections that require material verification.
2. Cooperate with agencies and laboratory personnel; provide access to approved documents at project site, to the work, to manufacturers' facilities, and to fabricators' facilities.
3. Provide incidental labor and facilities:
 - a. To provide safe access to work to be tested or inspected.
 - b. To obtain and handle samples at the site or at source of Products to be tested or inspected.
 - c. To facilitate tests or inspections at fabricator's or manufacturer's location, or project site.
 - d. To provide storage and curing of test samples at the project site.
4. Notify Special Inspection Agencies a minimum of 48 hours prior to expected time for operations requiring testing or inspection services. If, upon special inspector's arrival onsite at the designated time, special inspection or testing work is not able to be performed due to Contractor's operations, Contractor shall reimburse MBTA for the cost(s) of the special inspector until special inspection or testing services are performed.
5. Repair or replace work not meeting the requirements as directed by the DPRC.
6. Reimburse MBTA for cost of additional samples, tests, and inspections required due to failed tests or inspections.
7. The work for which special inspection or testing is required shall remain accessible and exposed for special inspections or testing purposes until completion of the required inspections or tests.

B. Contractor Responsibilities, Seismic Force-Resisting System;

Designated Seismic Systems and Seismic Force-Resisting Components: When required by the Contract Documents, submit written statement of responsibility for each item listed in the Statement of Special Inspections to AHJ and MBTA prior to starting work. Statement of responsibility shall acknowledge awareness of special construction requirements and other requirements listed.

- C. Contractor Responsibilities, Wind Force-Resisting System and Wind Force-Resisting Components: When required by the Contract Documents, submit written statement of responsibility for each item listed in the Statement of Special Inspections to AHJ and MBTA prior to starting work. Statement of responsibility shall acknowledge awareness of special construction requirements and other requirements listed.

3.5 MANUFACTURERS' AND FABRICATORS' FIELD SERVICES

- A. When specified in individual specification sections, require material suppliers, assembly fabricators, or product manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, to test, adjust, and balance equipment as applicable, and to initiate instructions when necessary.
- B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.6 SCHEDULE OF SPECIAL INSPECTIONS, GENERAL

- A. Frequency of Special Inspections: Special Inspections are indicated as continuous or periodic.
 - 1. Continuous Special Inspection: Special Inspection Agencies are required to be present in the area where the work is being performed and observe the work at all times the work is in progress.
 - 2. Periodic Special Inspection: Special Inspection Agencies are required to be present in the area where work is being performed and observe the work part-time or intermittently and at the completion of the work. Frequency of periodic Special Inspections is defined in the Statement of Special Inspections included in the Contract Documents.

3.7 SPECIAL INSPECTIONS FOR STEEL CONSTRUCTION

- A. Refer to Appendix A tables for requirements.
- B. Nondestructive Testing (NDT) of Welded Joints
 - 1. Procedures: Ultrasonic testing (UT), magnetic particle testing (MT), penetrant testing (PT) and radiographic testing (RT), where required, shall be performed in accordance with AWS D1.1.

- Acceptance criteria shall be in accordance with AWS D1.1 for statically loaded structures, unless otherwise designated in the design drawings or project specifications.
2. CJP Groove Weld NDT: For structures in Risk Category III or IV of Table 1.5-1, Risk Category of Buildings and Other Structures for Flood, Wind, Snow, Earthquake and Ice Loads, of ASCE/ SEI 7, Minimum Design Loads for Buildings and Other Structures, UT shall be performed on all CJP groove welds subject to transversely applied tension loading in butt, T- and corner joints, in materials 5/16 in. thick or greater. For structures in Risk Category II, UT shall be performed on 10% of CJP groove welds in butt, T- and corner joints subject to transversely applied tension loading, in materials 5/16 in. thick or greater.
 3. Access Hole NDT: Thermally cut surfaces of access holes shall be tested using MT or PT, when the flange thickness exceeds 2 in. for rolled shapes, or when the web thickness exceeds 2 in. for built-up shapes. Any crack shall be deemed unacceptable regardless of size or location.
 4. Welded Joints Subjected to Fatigue: When required by Appendix 3, Table A-3.1 of AISC 360, welded joints requiring weld soundness to be established by radiographic or ultrasonic inspection shall be tested as prescribed. Reduction in the rate of UT is prohibited.
 5. Reduction of Rate of Ultrasonic Testing: The rate of UT is permitted to be reduced if approved by the DPRC and the AHJ. Where the initial rate for UT is 100%, the NDT rate for an individual welder or welding operator is permitted to be reduced to 25%, provided the reject rate, the number of welds containing unacceptable defects divided by the number of welds completed, is demonstrated to be 5% or less of the welds tested for the welder or welding operator. A sampling of at least 40 completed welds for a job shall be made for such reduction evaluation. For evaluating the reject rate of continuous welds over 3 ft in length where the effective throat is 1 in. or less, each 12 in. increment or fraction thereof shall be considered as one weld. For evaluating the reject rate on continuous welds over 3 ft in length where the effective throat is greater than 1 in., each 6 in. of length or fraction thereof shall be considered one weld.
 6. Increase in Rate of Ultrasonic Testing: For structures in Risk Category II, where the initial rate for UT is 10%, the NDT rate for an individual welder or welding operator shall be increased to 100% should the reject rate, the number of welds containing unacceptable defects divided by the number of welds completed, exceeds 5% of the welds tested for the welder or welding operator. A sampling of at least 20 completed welds for a job shall be made

- prior to implementing such an increase. When the reject rate for the welder or welding operator, after a sampling of at least 40 completed welds, has fallen to 5% or less, the rate of UT shall be returned to 10%. For evaluating the reject rate of continuous welds over 3 ft in length where the effective throat is 1 in. or less, each 12-in. increment or fraction thereof shall be considered as one weld. For evaluating the reject rate on continuous welds over 3 ft in length where the effective throat is greater than 1 in., each 6 in. of length or fraction thereof shall be considered one weld.
7. Documentation: All NDT performed shall be documented. For shop fabrication, the NDT report shall identify the tested weld by piece mark and location in the piece. For field work, the NDT report shall identify the tested weld by location in the structure, piece mark, and location in the piece. When a weld is rejected on the basis of NDT, the NDT record shall indicate the location of the defect and the basis of rejection.

3.8 SPECIAL INSPECTIONS FOR CONCRETE CONSTRUCTION

- A. Refer to Appendix A tables for requirements.
- B. Materials: If the Contractor cannot provide sufficient data or documentary evidence that concrete materials comply with the quality standards of ACI 318, the AHJ shall require testing of materials in accordance with the appropriate standards and criteria in ACI 318, Chapters 19 and 20.

3.9 SPECIAL INSPECTIONS FOR MASONRY CONSTRUCTION

- A. Refer to Appendix A tables for requirements.
- B. Masonry Structures Subject to Special Inspection:
 1. Masonry construction when required by the quality assurance program of TMS 402/602.
 2. Empirically designed masonry, glass unit masonry and masonry veneer in structures designated as "essential facilities" or in Risk Category IV.
 - a. Perform inspections in accordance with TMS 402/602 Level B Quality Assurance.
 3. Engineered masonry in structures classified as "low hazard..." and "substantial hazard to human life in the event of failure".

3.10 SPECIAL INSPECTIONS FOR WOOD CONSTRUCTION

- A. Refer to Appendix A tables for requirements.

3.11 SPECIAL INSPECTIONS FOR EARTHWORK

- A. Refer to Appendix A tables for requirements.

- B. This article covers special inspection requirements for earthwork, including classification of backfill material, limits of excavation, fill placement, and the required degree of compaction of backfill materials. Some articles are not explicitly addressed in the building code but are provided to verify that construction is completed in accordance with the Contract Documents and to satisfy the AHJ.

3.12 SPECIAL INSPECTIONS FOR FOUNDATIONS

- A. Refer to Appendix A tables for requirements.
- B. This article covers special inspection requirements for materials, installation and testing of various foundations, including conventional spread footings (shallow foundations), driven piles, drilled shafts, drilled micropiles, underpinning and helical piles. Some articles are not explicitly addressed in the building code but are provided to verify that construction is completed in accordance with the Contract Documents and to satisfy the AHJ.

3.13 SPECIAL INSPECTIONS FOR RETAINING WALLS

- A. Refer to Appendix A tables for requirements.
- B. This article covers special inspection requirements for retaining walls constructed using drilled micropiles, modular precast blocks, concrete diaphragm walls, mechanically stabilized earth walls, steel sheet pile walls, soldier piles and lagging, permanent ground anchors and soil nails and secant piles. Some articles are not explicitly addressed in the building code but are provided to verify construction is completed in accordance with the Contract Documents and to satisfy the AHJ.

3.14 SPECIAL INSPECTIONS FOR GROUND IMPROVEMENT

- A. Refer to Appendix A tables for requirements.
- B. This article covers special inspection requirements for ground improvement performed using jet grouting, rammed aggregate piers, and rigid inclusions. This article is not explicitly addressed in the building code but is provided to verify that construction is completed in accordance with the Contract Documents and to satisfy the AHJ.
- C. Ground Improvement, for purposes of this Section, is defined as a system that uses elements of aggregate, concrete, grout, or other mixture of cementitious materials and/or aggregates, or other materials that are significantly stiffer than the ground being improved, installed into the ground upon which building foundation units such as footings, slabs or mats are supported, to improve the engineering properties of the bearing strata. The Ground Improvement system includes the elements and all strata and materials within the zone of influence beneath the foundation units.

3.15 SPECIAL INSPECTIONS FOR GEOSYNTHETICS

- A. Refer to Appendix A tables for requirements.
- B. This article covers special inspection requirements for geosynthetics, including geotextiles and geomembranes. Materials included under this article are not explicitly addressed in the building code; this information is provided to verify construction is completed in accordance with the Contract Documents and to satisfy the AHJ.

3.16 SPECIAL INSPECTIONS FOR SPRAYED FIRE-RESISTANT MATERIALS

- A. Refer to Appendix A tables for requirements.
- B. Sprayed Fire-Resistant Materials, General:
 - 1. Verify compliance of sprayed-fire resistant materials with specific fire-rated assemblies indicated in approved Contract Documents, and with applicable requirements of the building code.
 - 2. Perform special inspections after rough installation of electrical, mechanical, plumbing, automatic fire sprinkler and suspension systems for ceilings.
- C. Thickness: Verify that no more than 10 percent of thickness measurements taken from sprayed fire-resistant material are less than thickness required by fire resistance design in approved Contract Documents. In no case shall the thickness of the sprayed fire-resistant material be less than the minimum below.

3.17 SPECIAL INSPECTIONS FOR MASTIC AND INTUMESCENT FIRE-RESISTANT COATINGS

- A. Verify mastic and intumescent fire-resistant coatings comply with AWCI 117 and the fire resistance rating indicated on approved Contract Documents.

3.18 SPECIAL INSPECTIONS FOR EXTERIOR INSULATION AND FINISH SYSTEMS (EIFS)

- A. Verify water resistive barrier coating applied over sheathing complies with ASTM E2570/E2570M.

3.19 SPECIAL INSPECTIONS FOR FIRE RESISTANT PENETRATIONS AND JOINTS

- A. Verify penetration firestops in accordance with ASTM E2174.
- B. Verify fire resistant joints in accordance with ASTM E2393.

3.20 SPECIAL INSPECTIONS FOR SMOKE CONTROL

- A. Test smoke control systems as follows:
 - 1. Record device locations and test system for leakage after erection of ductwork but before starting construction that conceals or

blocks access to system.

2. Test and record pressure difference, flow measurements, detection function and controls after system is complete and before structure is occupied.

3.21 SPECIAL INSPECTIONS FOR SEISMIC RESISTANCE

- A. Refer to Appendix A tables for requirements.

3.22 SPECIAL INSPECTIONS FOR WIND RESISTANCE

- A. Refer to Appendix A tables for requirements.

3.23 STRUCTURAL OBSERVATIONS FOR STRUCTURES

- A. Provide Observations: For structure where one or more of the following conditions exist:
 1. The structure is classified as Risk Category IV.
 2. The structure is a high-rise building.
 3. Such observation is required by the registered the DPRC for the structural design.
 4. Such observation is specifically required by AHJ.

3.24 OTHER SPECIAL INSPECTIONS

- A. Provide for special inspection of work that, in the opinion of the AHJ, is unusual in nature.
- B. For the purposes of this section, work unusual in nature includes, but is not limited to:
 1. Construction materials and systems that are alternatives to materials and systems prescribed by the building code.
 2. Unusual design applications of materials described in the building code.
 3. Materials and systems required to be installed in accordance with the manufacturer's instructions when said instructions prescribe requirements not included in the building code or in standards referenced by the building code.
- C. Alternative Test Procedures: Where approved rules and standards do not exist, test materials and assemblies as required by AHJ or provide AHJ with documentation of quality and manner in which those materials and assemblies are used.
- D. Load Tests:
 1. Proposed Construction and Construction in Progress: Where required by code, conduct tests listed below.
 - a. Load test procedures specified in code; periodic.

- b. Load test procedures not specified in code; periodic.
 - c. Loadbearing Wall and Partition Assemblies: Load test with and without window framing; periodic.
 - d. Exterior Window and Door Assemblies: Wind load design pressure test; periodic.
2. Completed Construction: Where required by code, conduct tests listed below.
- a. Load test procedures specified in code; periodic.
 - b. Load test procedures not specified in code; periodic.

PART 4 - MEASUREMENT AND PAYMENT

No separate measurement or payment shall be made for work required under this Section. All costs in connection therewith shall be considered incidental to the item or items of work to which they pertain.

END OF SECTION

<u>REQ'D BY</u>¹	<u>DESCRIPTION OF TEST OR INSPECTION</u>	<u>FREQUENCY OF TEST OR INSPECTION</u>	<u>REFERENCE D STANDARD</u>	<u>IBC REFERENCE</u>²
SPECIAL INSPECTIONS FOR STEEL CONSTRUCTION				
	1. Review material test reports and certifications as follows for compliance with the contract documents:			

IBC	a. For structural steel elements, copies of material test reports	Periodic	AISC 360, Ch. N5.2 and applicable ASTM material standards	
	b. For structural steel castings and forgings, copies of material test reports	Periodic		
	c. For fasteners, copies of manufacturer's certifications	Periodic		
	d. For deck fasteners, copies of manufacturer's product data sheets or catalog data describing the product, limitations of use, and recommended or typical installation instructions	Periodic		
	e. For anchor rods, copies of material test reports	Periodic		
	f. For welding consumables, copies of manufacturer's certifications	Periodic		
	g. For headed stud anchors, copies of manufacturer's certifications	Periodic		
	h. Manufacturer's product data sheets or catalog data for welding filler metals and fluxes describing the product, limitations of use, recommended or typical welding parameters, storage and exposure requirements, including baking, if applicable	Periodic		
	i. Welding procedure specifications (WPS's)	Periodic		
	j. Procedure qualification records (PQR's) for WPS's that are not prequalified in accordance with AWS D1.1 or AWS D1.3 as applicable	Periodic		
	k. Welding personnel performance qualification records (WPQR) and continuity records	Periodic		
	l. Fabricators and erectors written quality control manual that shall include at a minimum			
	1) Material control procedures	Periodic		
	2) Inspection procedures	Periodic		
	3) Nonconformance procedures	Periodic		
	m. Fabricators and erectors QC inspector qualifications	Periodic		
IBC	2. Inspection of anchor rods and other embedments supporting structural steel for compliance with approved Construction Documents:		AISC 360, Ch. N5.7	
	a. Verify diameter, grade, type and length of each anchor rod or embedded item	Periodic		
	b. Verify extent or depth into concrete	Periodic		
IBC	3. Inspections prior to welding:			

	a. Welding procedure specifications (WPS's) available	Continuous	AISC 360, Table N5.4-1	
	b. Manufacturer's certifications for welding consumables available	Continuous		
	c. Material identification (type/grade)	Periodic		
	d. Welder identification system	Periodic		
	e. Fit-up of groove welds (including joint geometry):			
	1) Joint preparation	Periodic		
	2) Dimensions (alignment, root opening, root face, bevel)	Periodic		
	3) Cleanliness (condition of steel surface)	Periodic		
	4) Tacking (tack weld quality and location)	Periodic		
	5) Backing type and fit	Periodic		
	f. Configuration and finish of access holes	Periodic		
	g. Fit-up of fillet welds:			
	1) Dimensions (alignment, gaps at root)	Periodic		
	2) Cleanliness (condition of steel surfaces)	Periodic		
	3) Tacking (tack weld quality and location)	Periodic		
IBC	h. Check welding equipment	Periodic	AISC 360, Table N5.4-2	
	4. Inspections during welding:			
	a. Use of qualified welders	Periodic		
	b. Control and handling of welding consumables including packaging and exposure control	Periodic		
	c. No welding over cracked tack welds	Periodic		
	d. Environmental conditions; wind speed within limits, precipitation, and temperature	Periodic		
	e. WPS followed:			
	1) Settings on welding equipment	Periodic		
	2) Travel speed	Periodic		
	3) Selected welding material	Periodic		
	4) Shielding gas type/flow rate	Periodic		
	5) Preheat applied	Periodic		
	6) Interpass temperature maintained (min/max)	Periodic		
	7) Proper position	Periodic		
	f. Welding techniques:			
IBC	1) Interpass and final cleaning	Periodic	AISC 360, Table N5.4-3	
	2) Each pass within profile limitations	Periodic		
	3) Each pass meets quality requirements	Periodic		
	5. Inspections after welding:			
	a. Welds cleaned	Periodic		
IBC	b. Size, length and location of welds	Continuous		
	c. Welds meet visual acceptance criteria:			
	1) Crack prohibition	Continuous		
	2) Weld/base-metal fusion	Continuous		

	3) Crater cross section	Continuous		
--	-------------------------	------------	--	--

	4) Weld profiles	Continuous		
	5) Weld size	Continuous		
	6) Undercut	Continuous		
	7) Porosity	Continuous		
	d. Arc strikes	Continuous		
	e. k-area	Continuous		
	f. Backing removed and weld tab removed where required	Continuous		
	g. Repair activities	Continuous		
	h. Ultrasonic testing on field made partial or complete joint penetration welds ₃	Periodic		
	i. Ultrasonic testing on fillet welds not meeting the visual inspection requirements ₃	Periodic		
	j. Acceptance or rejection of welded joint or member	Continuous		
IBC	6. Inspections prior to bolting:		AISC 360, Table N5.6-1	
	a. Manufacturer's certifications are available for fastener materials	Periodic		
	b. Fasteners marked in accordance with ASTM requirements	Periodic		
	c. Proper fasteners are selected for the joint details:			
	1) Grade	Periodic		
	2) Type	Periodic		
	3) Bolt Length	Periodic		
	4) Threads included or excluded from the shear plain	Periodic		
	d. Proper bolting procedure selected for joint detail	Periodic		
	e. Connecting elements, including the appropriate faying surface condition and hole preparation, if specified, meet applicable requirements	Periodic		
	f. Pre-installation verification testing by installation personnel observed and documented for fastener assemblies and methods used	Continuous		
	g. Proper storage provided for bolts, nuts, washers, and other fastener components	Periodic		
IBC	7. Inspections during bolting:		AISC 360, Table N5.6-2	
	a. Fastener assemblies, of suitable condition, placed in all holes and washers (if required) are positioned as required	Periodic		
	b. Joint brought to the snug-tight condition prior to the pretensioning operation	Periodic		

	c. Fastener component not turned by the wrench prevented from rotating	Periodic		
	d. Fasteners are pretensioned in accordance with the RCSC Specification, progressing systematically from the most rigid point towards the free edges	Periodic		
IBC	8. Inspections after bolting:			

	a. Document acceptance or rejection of bolted connections	Continuous	AISC 360, Table N5.6-3	
IBC	9. Inspections prior to Cold-Formed Steel Deck placement:		SDI QA/QC, Table 1.1	
	a. Verify compliance of materials (deck and all deck accessories) with approved Construction Documents including profiles, material properties, and base metal thickness	Continuous		
	b. Document acceptance or rejection of deck and deck accessories	Continuous		
IBC	10. Inspections after Cold-Formed Steel Deck placement:		SDI QA/QC, Table 1.2	
	a. Verify compliance of deck and all deck accessories installation with approved Construction Documents	Continuous		
	b. Verify deck materials are represented by the mill certifications that comply with the approved Construction Documents	Continuous		
	c. Document acceptance or rejection of installation of deck and deck accessories	Continuous		
IBC	11. Inspections prior to welding Cold-Formed Steel Deck:		SDI QA/QC, Table 1.3	
	a. Welding procedure specifications (WPS) available	Periodic		
	b. Manufacturer certifications for welding consumables available	Periodic		
	c. Material identification (type/grade)	Periodic		
	d. Check welding equipment	Periodic		
IBC	12. Inspections during welding Cold-Formed Steel Deck:		SDI QA/QC, Table 1.4	
	a. Use of qualified welders	Periodic		
	b. Control and handling of welding consumables	Periodic		
	c. Environmental conditions (wind speed, moisture, temperature)	Periodic		
	d. WPS followed	Periodic		
IBC	13. Inspections after welding Cold-Formed Steel Deck:		SDI QA/QC, Table 1.5	
	a. Verify size and location of welds, including support, sidelap, and perimeter welds	Continuous		
	b. Welds meet visual acceptance criteria	Continuous		
	c. Verify repair activities	Continuous		
	d. Document acceptance or rejection of welds	Continuous		
	14. Inspections prior to mechanical fastening of Cold-Formed Steel Deck:		SDI QA/QC,	
	a. Manufacturer installation instructions are available for mechanical fasteners	Periodic		

IBC	b. Proper tools available for fastener installation	Periodic	Table 1.6	
	c. Proper storage for mechanical fasteners	Periodic		

IBC	15. Inspections during mechanical fastening of Cold-Formed Steel Deck:		SDI QA/QC, Table 1.7	
	a. Fasteners are positioned as required	Periodic		
	b. Fasteners are installed in accordance with the manufacturer's instructions	Periodic		
IBC	16. Inspections after mechanical fastening of Cold-Formed Steel Deck:		SDI QA/QC, Table 1.8	
	a. Check spacing, type, and installation of support fasteners	Continuous		
	b. Check spacing, type, and installation of sidelap fasteners	Continuous		
	c. Check spacing, type, and installation of perimeter fasteners	Continuous		
	d. Verify repair activities	Continuous		
	e. Document acceptance or rejection of mechanical fasteners	Continuous		
IBC	17. Inspection of the erected steel frame for compliance with approved Construction Documents:		AISC 360, Ch. N5.7	
	a. Details such as braces and stiffeners	Periodic		
	b. Member locations	Periodic		
	c. Proper application of joint details at each connection	Periodic		
IBC	18. Installation of Open Web Steel Joists:		SJI 100	1705.2.3
	a. End Connections - Welding or Bolted	Periodic		
	b. Bridging - Horizontal or Diagonal:			
	1) Standard bridging	Periodic		
	2) Bridging that differs from the SJI Specifications	Periodic		
IBC	19. Verify that the temporary installation restraint/bracing and the permanent individual truss member restraint/bracing are installed in accordance with the approved truss submittal package for Cold-Formed Steel Trusses spanning 60 feet or more.	Periodic		1705.2.4

¹ "MBTA" are tests required by the MBTA. "IBC" are tests required by Chpt. 17 of the 2015 International Building Code.

² 2015 International Building Code.

³ Refer to Article 3.6.B for additional information regarding NDT.

REQ'D BY¹	DESCRIPTION OF TEST OR INSPECTION	FREQUENCY OF TEST OR INSPECTION	REFERENCE STANDARD	IBC REFERENCE²
SPECIAL INSPECTIONS FOR CONCRETE CONSTRUCTION				
IBC	1. Verify plastic concrete complies with the design mix in approved Contract Documents	Periodic	ACI 318 Chapter 19 and Sections 26.4.3, 26.4.4	1904.1, 1904.2, 1908.2, 1908.3
IBC	2. Inspect reinforcement, including prestressing tendons, and verify placement	Periodic	ACI 318 Chapter 20 and Sections 25.2, 25.3, 26.6.1-26.6.3	1908.4
IBC	3. Inspections of reinforcing bar welding:		AWS D1.4; ACI 318 Section 26.6.4	
	a. Verify weldability of reinforcing bars other than those complying with ASTM A706	Periodic		
	b. Inspect single-pass fillet welds, maximum 5/16 inch	Periodic		
	c. Inspect all other welds	Continuous		
IBC	4. Inspect anchors cast in concrete	Periodic	ACI 318 Sections 17.8.2, 26.7	
IBC	5. Inspect formwork for shape, location and dimensions of the concrete member being formed	Periodic	ACI 318 Section 26.11.1.2(b)	
IBC	6. Inspect concrete and shotcrete placement for proper application techniques	Continuous	ACI 318 Section 26.5	1908.6, 1908.7, 1908.8
IBC	7. Prior to concrete placement:		ASTM C172, C31; ACI 318 Sections 26.4, 26.12	1908.10
	a. Fabricate specimens for strength tests	Continuous		
	b. Perform slump tests	Continuous		
	c. Perform air content tests	Continuous		
	d. Determine the temperature of the concrete	Continuous		
IBC	8. Verify maintenance of specified curing temperature and techniques	Periodic	ACI 318 Sections 26.5.3-	1908.9

			26.5.5	
IBC	9. Prestressed Concrete: Verify compliance with approved Contract Documents:		ASCI 318 Section 26.10	
	a. Application of prestressing forces	Continuous		
	b. Grouting of bonded prestressing tendons	Continuous		

IBC	10. Verify erection techniques and placement of precast elements comply with approved Contract Documents	Periodic	ACI 318 Section 26.9	
IBC	11. Verify in-situ concrete strength complies with approved Contract Documents		ACI 318 Sections 26.10.2, 26.11.2	
	a. Post-tensioned concrete, prior to stressing of tendons	Periodic		
	b. Beams and structural slabs, prior to removal of shores and forms	Periodic		
IBC	12. Verify compliance of anchors post-installed in hardened concrete:			
	a. Adhesive Anchors: Verify horizontally or upwardly-inclined orientation installations resisting sustained tension loads	Continuous	ACI 318 Section 17.8.2.4	
	b. Other Mechanical and Adhesive Anchors	Periodic	ACI Section 17.8.2	

¹ "MBTA" are tests required by the MBTA. "IBC" are tests required by Chpt. 17 of the 2015 International Building Code.

² 2015 International Building Code.

REQ'D BY¹	DESCRIPTION OF TEST OR INSPECTION	FREQUENCY OF TEST OR INSPECTION	REFERENCE STANDARD	IBC REFERENCE²
SPECIAL INSPECTIONS FOR MASONRY CONSTRUCTION				
Level B Quality Assurance				
Minimum Tests				
IBC	Verify slump flow and Visual Stability Index (VSI) as delivered to the project site for self-consolidating grout		TMS 602/ACI 530.1/ASCE 6 Article 1.5B.1.b.3	
IBC	Verify f'_m and f'_{AAC} prior to construction except where specifically exempted by the Code		TMS 602/ACI 530.1/ASCE 6 Article 1.4B	
Minimum Special Inspection				
IBC	1. Verify compliance with the approved submittals	Periodic	TMS 602/ACI 530.1/ASCE 6 Article 1.5	
IBC	2. As masonry construction begins, verify that the following are in compliance:			
	a. Proportions of site prepared mortar	Periodic	TMS 602/ACI 530.1/ASCE 6 Article 2.1, 2.6A	
	b. Construction of mortar joints	Periodic	TMS 602/ACI 530.1/ASCE 6 Article 3.3B	
	c. Grade and size of prestressing tendons and anchorages	Periodic	TMS 602/ACI 530.1/ASCE 6 Article 2.4B, 2.4H	
	d. Location of reinforcement, connectors, prestressing tendons, anchorages, etc.	Periodic	TMS 602/ACI 530.1/ASCE 6 Article	

			3.4, 3.6A	
	e. Prestressing technique	Periodic	TMS 602/ACI 530.1/ASCE 6 Article 3.6B	
	f. Properties of the first 5,000 square feet of thin-bed mortar for AAC masonry	Continuous	TMS 602/ACI 530.1/ASCE 6 Article 2.1C	
	g. Properties of the after the first 5,000 square feet of thin-bed mortar for AAC masonry	Periodic		
IBC	3. Prior to grouting, verify that the following are in compliance:			

	a. Grout space	Periodic	TMS 602/ACI 530.1/ASCE 6 Article 3.2D, 3.2F	
	b. Grade, type, and size of reinforcement and anchor bolts, and prestressing tendons and anchorage	Periodic	TMS 402/ACI 530/ASCE 5 Section 6.1; TMS 602/ACI 530.1/ASCE 6 Article 2.4, 3.4	
	c. Placement of reinforcement, connectors, and prestressing tendons and anchorages	Periodic	TMS 402/ACI 530/ASCE 5 Section 6.1, 6.2.1, 6.2.6, 6.2.7; TMS 602/ACI 530.1/ASCE 6 Article 3.2E, 3.4, 3.6A	
	d. Proportions of site-prepared grout and prestressing grout for bonded tendons	Periodic	TMS 602/ACI 530.1/ASCE 6 Article 2.6B, 2.4G.1.b	
	e. Construction of mortar joints	Periodic	TMS 602/ACI 530.1/ASCE 6 Article 3.3B	
IBC	4. Verify during construction:			
	a. Size and location of structural elements	Periodic	TMS 602/ACI 530.1/ASCE 6 Article 3.3F	
	b. Type, size, and location of anchors, including other details of anchors of masonry to structural members, frames, or other construction	Periodic	TMS 402/ACI 530/ASCE 5 Section n 1.2.1(e) , 6.1.4.3, 6.2.1	
			TMS	

	c. Welding of reinforcement	Continuous	402/ACI 530/ASCE 5 Section 8.1.6.7.2, 9.3.3.4(c), 11.3.3.4(b)	
	d. Preparation, construction, and protection of masonry during cold weather (temperature below 40 degrees F) or hot weather (temperature above 90 degrees F)	Periodic	TMS 602/ACI 530.1/ASCE 6 Article 1.8C, 1.8D	

	e. Application and measurement of prestressing force	Continuous	TMS 602/ACI 530.1/ASCE 6 Article 3.6B	
	f. Placement of grout and prestressing grout for bonded tendons is in compliance	Continuous	TMS 602/ACI 530.1/ASCE 6 Article 3.5, 3.6C	
	g. Placement of the first 5,000 square feet of AAC masonry units and construction of thin-bed mortar joints	Continuous	TMS 602/ACI 530.1/ASCE 6 Article 3.3B.9, 3.3F.1.b	
	h. Placement after the first 5,000 square feet of AAC masonry units and construction of thin-bed mortar joints	Periodic		
IBC	5. Observe preparation of grout specimens, mortar specimens and/or prisms	Periodic	TMS 602/ACI 530.1/ASCE 6 Article 1.4B.2.a. 3, 1.4B.2.b.3, 1.4B.2.c.3, 1.4B.3, 1.4B.4	
Level C Quality Assurance				
Minimum Tests				
IBC	Verify f'_m and f'_{AAC} prior to construction and for every 5,000 square feet during construction		TMS 602/ACI 530.1/ASCE 6 Article 1.4B	
IBC	Verify proportions of materials in premixed or preblended mortar, prestressing grout, and grout other than self-consolidating grout as delivered to the project site			
IBC	Verify slump flow and Visual Stability Index (VSI) as delivered to the project site for self-consolidating grout		TMS 602/ACI 530.1/ASCE 6 Article 1.5B.1.b.3	
Minimum Special Inspection				
IBC	1. Verify compliance with the approved submittals	Periodic	TMS 602/ACI 530.1/ASCE 6 Article 1.5	

IBC	2. Verify that the following are in compliance:			
	a. Proportions of site-mixed mortar, grout, and prestressing grout for bonded tendons	Periodic	TMS 602/ACI 530.1/ASCE 6 Article 2.1, 2.6A, 2.6B, 2.6C, 2.4G.1.b	
	b. Grade, type, and size of reinforcement and anchor bolts, and prestressing tendons and anchorage	Periodic	TMS 402/ACI 530/ASCE 5 Section 6.1; TMS 602/ACI 530.1/ASCE 6 Article 2.4, 3.4	

c. Placement of masonry units and construction of mortar joints	Periodic	TMS 602/ACI 530.1/ASCE 6 Article 3.3B
d. Placement of reinforcement, connectors, and prestressing tendons and anchorages	Continuous	TMS 402/ACI 530/ASCE 5 Section 6.1, 6.2.1, 6.2.6, 6.2.7; TMS 602/ACI 530.1/ASCE 6 Article 3.2E, 3.4, 3.6A
e. Grout space prior to grouting	Continuous	TMS 602/ACI 530.1/ASCE 6 Article 3.2D, 3.2F
f. Placement of grout and prestressing grout for bonded tendons	Continuous	TMS 602/ACI 530.1/ASCE 6 Article 3.5, 3.6C
g. Size and location of structural elements	Periodic	TMS 602/ACI 530.1/ASCE 6 Article 3.3F
h. Type, size, and location of anchors, including other details of anchors of masonry to structural members, frames, or other construction	Continuous	TMS 402/ACI 530/ASCE 5 Section 1.2.1(e), 6.1.4.3, 6.2.1
i. Welding of reinforcement	Continuous	TMS 402/ACI 530/ASCE 5 Section 8.1.6.7.2, 9.3.3.4(c), 11.3.3.4(b)
j. Preparation, construction, and protection of masonry during cold weather (temperature below 40 degrees F) or hot weather (temperature above 90 degrees F)	Periodic	TMS 602/ACI 530.1/ASCE 6 Article 1.8C, 1.8D
k. Application and measurement of prestressing force	Continuous	TMS 602/ACI 530.1/ASCE 6 Article 3.6B

	l. Placement of AAC masonry units and construcion of thin-bed mortar joints	Continuous	TMS 602/ACI 530.1/ASCE 6 Article 3.3B.9, 3.3F.1.b	
	m. Properties of thin-bed mortar for AAC masonry	Continuous	TMS 602/ACI 530.1/ASCE 6 Article 2.1C.1	
IBC	5. Observe preparation of grout specimens, mortar specimens and/or prisms	Continuous	TMS 602/ACI 530.1/ASCE 6 Article 1.4B.2.a. 3, 1.4B.2.b.3, 1.4B.2.c.3, 1.4B.3, 1.4B.4	

¹ "MBTA" are tests required by the MBTA. "IBC" are tests required by Chpt. 17 of the 2015 International Building Code.

² 2015 International Building Code.

<u>REQ'D BY¹</u>	<u>DESCRIPTION OF TEST OR INSPECTION</u>	<u>FREQUENCY OF TEST OR INSPECTION</u>	<u>REFERENCE STANDARD</u>	<u>IBC REFERENCE²</u>
SPECIAL INSPECTIONS FOR WOOD CONSTRUCTION				
IBC	1. Verify the following are in compliance with the approved Contract Documents for High Load Diaphragms:			
	a. Grade and thickness of sheathing	Periodic		
	b. Nominal size of framing members at adjacent panel edges	Periodic		
	c. Nail or staple diameter and length	Periodic		
	d. Number of fastener lines	Periodic		
	e. Fastener spacing at lines and at edges	Periodic		
IBC	2. Verify the following are in general compliance with the approved Contract Documents and in compliance with the approved truss submittal package for Metal Plate Connected Wood Trusses with a clear span of 60-feet or more:			
	a. Temporary restraint and bracing	Periodic		
	b. Permanent individual truss member restraint and bracing	Periodic		

¹ "MBTA" are tests required by the MBTA. "IBC" are tests required by Chpt. 17 of the 2015 International Building Code.

² 2015 International Building Code.

REQ'D BY ¹	DESCRIPTION OF TEST OR INSPECTION	FREQUENCY OF TEST OR INSPECTION	REFERENCE STANDARD	IBC REFERENCE ²
SPECIAL INSPECTIONS FOR SPRAYED FIRE-RESISTANT MATERIALS				
IBC	1. Verify the following are in compliance with the fire resistance rating:			
	a. Condition of substrates	Periodic		
	b. Thickness of sprayed fire-resistant material	Periodic		
	c. Density of sprayed fire-resistant material in pounds per cubic foot	Periodic		
	d. Bond strength (adhesion and cohesion)	Periodic		
	e. Condition of finished application	Periodic		
IBC	2. Inspect structural member surfaces before application of sprayed fire-resistant materials	Periodic		
IBC	3. Verify preparation of structural member surfaces complies with approved Contract Documents and manufacturer's written instructions	Periodic		
IBC	4. Ensure minimum ambient temperature before and after application complies with the manufacturer's written instructions	Periodic		
IBC	5. Verify area where sprayed fire resistant material is applied is ventilated as required by the manufacturer's written instructions during and after application	Periodic		
IBC	6. Thickness: Verify that no more than 10 percent of thickness measurements taken from sprayed fire-resistant material are less than thickness required by fire resistance design in approved Contract Documents. In no case shall the thickness of the sprayed fire-resistant material be less than the minimum below:		ASTM E605	
	a. Minimum Allowable Thickness: Tested according to ASTM E605	Periodic		
	1) Design thickness 1 inch or greater: Design thickness minus 1/4 inch			
	2) Design thickness greater than 1 inch: Design thickness minus 25 percent			
	b. Floor, Roof and Wall Assemblies: Test thickness according to ASTM E605 with no less than four measurements per 1,000 square feet of sprayed area on each story of the structure or portion thereof	Periodic		
	1) Cellular Decks: Measure thickness within a single 12 inch by 12			

	inch area. Make a minimum of four measurements arranged symmetrically in testing area			
--	---	--	--	--

	2) Fluted Decks: Measure thickness within a single 12 inch by 12 inch area. Make a minimum of four measurements arranged symmetrically in testing area and include one example each of valley, crest and sides. Report the average of the four measurements	Periodic		
	c. Structural Members: Test according to ASTM E605. Test no less than 25 percent of structural members on each story of the structure or portion thereof			
	1) Beams and girders: Make nine thickness measurements around beam or girder at each end of a 12 inch by 12 inch length			
	2) Joists and trusses: Make seven thickness measurements around joist or truss at each end of a 12 inch by 12 inch length			
	3) Wide flanged columns: Make twelve thickness measurements around column at each end of a 12 inch by 12 inch length			
	4) Hollow structural sections and pipe columns: Make four thickness measurements around hollow structural section or pipe column at each end of a 12 inch by 12 inch length			
IBC	7. Verify density of sprayed fire-resistant material is no less than density required by the fire resistance design in the approved Contract Documents	Periodic	ASTM E605	
	a. Floor, Roof and Wall Assemblies: Test according to ASTM E605 with no less than one sample per 2,500 square feet of sprayed area on each story of the structure or portion thereof			
	b. Beams, Girders, Trusses and Columns: Test according to ASTM E605 with no less than one sample per 2,500 square feet of sprayed area on each story of the structure or portion thereof			
IBC	8. Verify adhesive and cohesive bond strength of sprayed fire-resistant materials is no less than 150 pounds per square foot when in-place samples of the cured material are tested according to ASTM E736 and as described below	Periodic	ASTM E736	
	a. Floor, roof and wall assemblies: Test no less than one sample per each 2,500 square feet of sprayed area on each story of the structure or portion thereof			

	b. Structural members: Test no less than one sample from each type of structural member in each 2,500 square feet of each story of the structure or portion thereof	Periodic		
--	---	----------	--	--

	c. Primer, paint and encapsulant bond tests: When sprayed fire-resistant material is applied to a primed, painted or encapsulated surface for which acceptable material to substrate performance has not been determined, conduct bond test	Periodic		
--	---	----------	--	--

¹ "MBTA" are tests required by the MBTA. "IBC" are tests required by Chpt. 17 of the 2015 International Building Code.

² 2015 International Building Code.

REQ'D BY¹	DESCRIPTION OF TEST OR INSPECTION	FREQUENCY OF TEST OR INSPECTION	REFERENCE STANDARD	IBC REFERENCE²
SPECIAL INSPECTIONS FOR SEISMIC RESISTANCE				
IBC	1. Structural Steel: Comply with the quality assurance plan requirements of AISC 341			
IBC	2. Structural Wood:			
	a. Field gluing of components within the seismic force-resisting system	Continuous		
	b. Nailing, bolting, anchoring and other fastening of components within the seismic force-resisting system	Periodic		
IBC	3. Cold Formed Steel Light Frame Construction:			
	a. Field welding of components within the building seismic force-resisting system	Periodic		
	b. Screw attachment, bolting, anchoring and other fastening of components within the main seismic force-resisting system	Periodic		
IBC	4. Storage Racks and Access Floors: Anchorage	Periodic		
IBC	5. Architectural Components: Erection and fastening of components below:			
	a. Exterior cladding	Periodic		
	b. Interior and exterior veneer	Periodic		
	c. Interior and exterior non-loadbearing walls and partitions	Periodic		
IBC	6. Mechanical and Electrical Components:			
	a. Anchorage of electric equipment required for emergency or standby power systems	Periodic		
	b. Installation and anchorage of other electrical equipment	Periodic		
	c. Installation of piping systems for flammable, combustible or highly-toxic contents and associated mechanical units	Periodic		
	d. Installation of HVAC ductwork that will contain hazardous materials	Periodic		
	e. Vibration isolation systems where the approved Contract Documents require a nominal clearance of 1/4 inch or less between support frame and seismic restraint	Periodic		
	f. Installation of mechanical and electrical equipment, including duct			

	work, piping systems and their structural supports, where automatic fire sprinkler systems are installed:			
	1) Verify clearances have been provide as required by Section 13.2.3 of ASCE 7	Periodic		

	2) Verify nominal clearance of 3 inches has been provided between fire protection sprinkler drops and sprigs and: structural members not used collectively or independently to support the sprinklers; equipment attached to the building structure; and other systems' piping	Periodic		
IBC	7. Seismic Isolation Systems:			
	a. Fabrication and installation of isolator units	Periodic		
	b. Fabrication and isolation of energy dissipation devices	Periodic		
IBC	8. Cold-Formed Steel Special Bolted Moment Frames:			
	a. Installation in seismic force-resisting systems	Periodic		
IBC	9. Designated Seismic System Verification: Verify label, anchorage or mounting complies with certificate of compliance provided by manufacturer or fabricator	Periodic		
IBC	10. Structural Testing for Seismic Resistance:			
	a. Concrete reinforcement: Verify compliance of the following:		ACI 318 Section 3.5.2, 21.1.5.2; ASTM A615	
	1) Materials: Obtain mill certificates demonstrating compliance	Periodic		
	2) Welding: Perform chemical tests to determine weldability	Periodic		
	b. Structural Steel: Verify compliance with the quality assurance requirements of AISC 341			
	c. Non-Structural Components:		ASCE 7 Section 13.2.1, 13.2.2	
	1) General Design Requirements: Obtain manufacturer certification of compliance with requirements of ASCE 7	Periodic		
	2) Designated Seismic Force-Resisting Non-Structural System Components: Obtain manufacturer certification of compliance with ASCE 7	Periodic		
	d. Seismically Isolated Structures: Test system in accordance with ASCE 7	Periodic	ASCE 7 Section 17.8	
IBC	10. Visually observe structural system for general compliance with the approved Contract Documents	Periodic		

¹ "MBTA" are tests required by the MBTA. "IBC" are tests required by Chpt. 17 of the 2015 International Building Code.

² 2015 International Building Code.

REQ'D BY¹	<u>DESCRIPTION OF TEST OR INSPECTION</u>	<u>FREQUENCY OF TEST OR INSPECTION</u>	<u>REFERENCE STANDARD</u>	<u>IBC REFERENCE</u>²
SPECIAL INSPECTIONS FOR WIND RESISTANCE				
IBC	1. Structural Wood:			
	a. Field gluing of components within the main wind force-resisting system	Continuous		
	b. Nailing, bolting, anchoring and other fastening of components within the main wind force-resisting system	Periodic		
IBC	2. Cold Formed Steel Light Frame Construction:			
	a. Field welding of components within the main wind force-resisting system	Periodic		
	b. Screw attachment, bolting, anchoring and other fastening of components within the main wind force-resisting system	Periodic		
IBC	3. Wind Resisting Components			
	a. Roof covering, roof deck, and roof-framing connections	Periodic		
	b. Exterior wall coverings and wall connections to roof and floor diaphragms and framing	Periodic		
IBC	4. Visually observe structural system for general compliance with the approved Contract Documents	Periodic		

¹ "MBTA" are tests required by the MBTA. "IBC" are tests required by Chpt. 17 of the 2015 International Building Code.

² 2015 International Building Code.

REQ'D BY¹	DESCRIPTION OF TEST OR INSPECTION	FREQUENCY OF TEST OR INSPECTION	REFERENCE STANDARD	IBC REFERENCE²
SPECIAL INSPECTIONS FOR EARTHWORK				
IBC	1. Verify excavations have been performed to the required depths and lateral dimensions and have reached the proper materials indicated on the Contract Documents.	Periodic		Section 1705.6
IBC	2. Verify that the excavation subgrade has been prepared in accordance with the Contract Documents.	Continuous		Table 1705.6
IBC	3. Verify use of correct fill materials, lateral limits and loose/wet lift thicknesses prior to and during placement, compaction equipment and number of passes during compaction, record plan location and elevation of compaction tests performed; continuous.	Continuous	As specified by DPRC	Section 1705.6
MBTA	4. Completed Fill Placement: Compile field reports documenting subgrade acceptance, bottom elevation and lateral limits of excavation, placement and compaction of fill materials, and other quality assurance tests required by the Contract Documents.	Periodic	Technical Specifications	
IBC	5. Compacted Fill Materials:			
	a. Prior to delivery to the site and periodically during earthwork perform classification and testing of compacted fill materials to verify compliance with Contract Documents.	Periodic	ASTM D6913, ASTM D4318 and ASTM D1557 and other pertinent tests required to verify compliance with Contract Documents.	Table 1705.6
	b. Verify percent compaction achieved based on dry density and moisture content of compacted fill soils; continuous.	Method and frequency shall be specified by DPRC.	ASTM D6838, D2167, or other method acceptable to the DPRC.	Table 1705.6

IBC	6. Lightweight Fill Materials			
	a. Verify delivered Bulk Density. Upon receipt of lightweight aggregate to the site, verify loose bulk density for compliance with Contract Documents and specifications.	Frequency shall be specified by DPRC.	ASTM C-29/C-29M-17a	Section 1705.6
	b. Expanded Shale Aggregate.			

	i. Prior to beginning placement of expanded shale aggregate, observe and document Contractor's test section to verify in- place compacted density will be achieved based on proposed compaction equipment and number of passes. Record in-situ density of expanded shale aggregate from test section.	Periodic	As specified by DPRC.	Section 1705.6
	ii. During production placement of expanded shale aggregate, check density of in- place material. The in-place compacted dry density shall be at least 90 percent of the maximum dry density.	Continuous	ASTM D-4253 and ASTM D-4254.	Section 1705.6
	c. Ultra-lightweight Foamed Glass Aggregate (UL-FGA).			
	i. Verify compaction equipment and number of passes during compaction, and compacted lift thickness after compaction for compliance with Contract Documents and specifications; continuous. Lifts should not be compacted more than 20% of loose lift thickness (1.25 Compression Ratio).	Continuous	As specified by DPRC.	Section 1705.6
IBC	7. Lightweight Cellular Concrete			
	a. Verify wet density.	Periodic	ASTM C-796	Section 1705.6
	b. Sample and cast samples for compressive strength testing.	Periodic	ASTM C-495, except that samples shall not be oven dried at any time before testing.	Section 1705.6
IBC	8. Expanded Polystyrene (EPS) Blocks			
	a. Verify EPS foam blocks delivered to site are stored and protected.	Periodic	Manufacturer's requirements	Section 1705.6
	b. Verify placement of leveling course at correct location and elevation to specified tolerances prior to setting EPS blocks.	Periodic		Section 1705.6
	c. Verify bottom EPS blocks are properly placed and have correct orientation/pattern based on approved shop drawings.	Periodic		Section 1705.6
	d. Verify correct EPS blocks are being placed (size, density) in correct orientation/pattern with proper number of connection plates per each lift.	Periodic		Section 1705.6

	e. Verify gaps between blocks are filled with material specified in the Contract Documents prior to proceeding to next course of blocks.	Periodic		Section 1705.6
	f. Verify ancillary items (e.g., catch basins, storm-water piping, etc.) within the EPS block fill mass are installed in accordance with approved drawings and specifications and/or approved submittals.	Periodic		Section 1705.6

	g. Verify geomembrane cover at top of EPS blocks is placed and seamed and penetrations sealed, and inspections/tests performed by Contractor in accordance with Contract Documents and approved shop drawings/submittals.	Continuous		Section 1705.6
--	---	------------	--	-------------------

¹ "MBTA" are tests required by the MBTA. "IBC" are tests required by Chpt. 17 of the 2015 International Building Code.

² 2015 International Building Code.

REQ'D BY¹	DESCRIPTION OF TEST OR INSPECTION	FREQUENCY OF TEST OR INSPECTION	REFERENCE STANDARD	IBC REFERENCE²
SPECIAL INSPECTIONS FOR FOUNDATIONS				
	1. Shallow Foundations:			
IBC	a. Visually confirm that subgrade materials for shallow foundations are as indicated in the Contract Documents and the project Geotechnical Engineering Report and satisfy the Building Code requirements.	Periodic		Section 1705.6
	b. Verify excavations have been performed to the required depths and lateral dimensions and have reached the proper subgrade materials indicated on the Contract Documents.	Periodic		Section 1705.6
	c. Verify that the foundation subgrade has been prepared in accordance with the Contract Documents.	Continuous		Section 1705.6
	d. Verify placement of compacted fill below and around foundations.	See Article 3.10		Table 1705.6
MBTA	e. Completed Foundation Subgrades:			
	i. Compile field reports documenting subgrade acceptance, type and depth to bearing soils, limits of excavation, and placement and compaction of each lift of compacted fill materials.	Periodic	Technical Specifications	
	2. Driven Piles:			
IBC	a. Inspect condition of piles before driving.	Periodic		Table 1705.7
	b. Observe, log and maintain a complete and accurate record of driving operations for test piles used to verify pile driveability and specified ultimate capacity of driven piles as required by the Contract Documents and the Design Professional in Responsible Charge.	Continuous		Table 1705.7
	c. Confirm with the Design Professional in Responsible Charge that the static load test and/or dynamic load test results satisfy the requirements of the Contract Documents prior to commencing installation of production piles.	Periodic		Table 1705.7
	d. Observe, log and maintain a complete and accurate record of driving operations for each production element.	Continuous		Table 1705.7
	i. Verify pile element material, size, length, splices (if applicable), special coating (if applicable), tip protection, and allowable capacity for compliance.	Continuous	As specified by DPRC.	Table 1705.7

	ii. Verify placement location and plumbness, type and size of hammer(s), pile cushion (if applicable), installation time per foot for vibratory driving (if applicable), hammer stroke for impact driving, number of blows per foot of installation, record number of blows for final installation criterion in blows per inch of installation; minimum required penetration into bearing strata, record pile tip and butt elevations provided by contractor's surveyor prior to pile cut off, and document any damage to driven pile element or any sudden loss of driving resistance.	Continuous	As specified by DPRC.	Section 1705.7
	iii. Verify heave of previously installed piles driven in pile groups as required by Contract Documents. Redrive piles if heave criterion exceeded.	Continuous		Section 1705.7 / 1810.4.6
	iv. Verify depth to soil from top of pile inside driven, open end pipe piles, if applicable.	Continuous		Section 1705.7
	e. Verify pile splices for compliance (if applicable):			
	i. Welded splices.	Continuous	AWS D1.1 / D1.1M	Table 1705.7
	ii. Bolted splices with manufacturer requirements.	Continuous	As specified by Manufacturer.	Section 1705.7
	f. For steel piles, perform additional special inspections.	See Article 3.6		Table 1705.7
	g. For concrete filled pipe piles, perform additional special inspections.	See Article 3.7		Table 1705.7
	h. For pile elements with coating or preservative treatments provide certificates for compliance.	Periodic		Section 1705.7
MBTA	i. Completed Driven Pile: At the completion of installation of driven piles within each pile cap, or group of piles, perform the following tasks:	Periodic		
	i. Complete installation forms that document the installation and final driving criteria for the driven piles.		Technical Specifications	
	ii. Record the quantity for each pay item at each completed driven pile and verify agreement with the contractor for these quantities.		Technical Specifications	
	iii. Compile and file all inspection records for the completed driven piles.		Technical Specifications	
	iv. Update any project control summary tables and charts for driven pile construction.		Technical Specifications	

	3. Drilled Shafts / Load Bearing Elements (LBE):			
IBC	a. Confirm with the Design Professional in Responsible Charge that the static load test and/or dynamic load test results satisfy the requirements of the Contract Documents prior to commencing installation of production shafts or LBEs.	Periodic		Section 1705.8

b. Observe, log and maintain a complete and accurate record of pre-construction core borings as specified in the Contract Documents or required by the Design Professional in Responsible Charge.	Continuous		Table 1705.8
c. Verify drilled shaft/LBE element materials, sizes, and lengths for compliance.	Continuous		Table 1705.8
d. Observe, log and maintain a complete and accurate record of each drilled shaft/LBE.	Continuous		Table 1705.8
e. Verify acceptability of drilling fluids (if applicable) during drilling and prior to concrete placement for compliance.	Periodic	Contract Documents and Approved Contractor Submittals	Section 1705.8
f. Record plumbness and elevations, shaft diameters/ LBE dimensions, bell diameters (if applicable), shaft/LBE lengths, permanent casing lengths and sizes (if applicable), soil/rock strata, quantity/type of any obstructions encountered, drilling methods/rates used to excavate soil/bedrock and penetrate obstructions, size and diameter of temporary casing, embedment lengths into bearing strata.	Continuous		Section 1705.8
g. Document any unusual or unanticipated conditions observed during excavation such as, evidence of caving, bottom heave or other signs of hole instability; soil or rock conditions significantly different than those indicated in nearby investigation and/or pre-construction core borings; slow or difficult drilling progress; loss of drilling fluid; surface settlement or other signs of ground loss around the excavation.	Continuous		Section 1705.8
h. Verify cleanliness of shaft/LBE bottom prior to reinforcement placement and immediately prior to concrete placement.	Continuous		Section 1705.8
i. Reinforcement Cages:			
i. Verify steel grade, dimensions, arrangement, sizes and spacing.	Periodic		Section 1705.8
ii. Verify the types, sizes and spacing centering devices and verify rebar cage bottom spacers ("boots") are installed, if required.	Periodic		Section 1705.8
iii. Verify material, size, condition, number and arrangement of CSL (cross-hole sonic logging) tubing (if applicable). Verify CSL tubes are watertight and have end caps.	Periodic		Section 1705.8
iv. Verify other embedded devices are installed as required. Other devices			Section

	may include post-grout tubes, TIP cables, bi-directional load test devices, and geotechnical instrumentation.	Periodic		n 1705. 8
--	---	----------	--	-----------------

	v. Verify splices are performed in accordance with the requirements of the Contract Documents and approved Installation Plan. Note splice lap lengths; the type, size and installation procedure for mechanical splices; and the staggering of the splices.	Periodic		Section 1705.8
	vi. Perform additional special inspections for reinforcement used for drilled shafts and LBEs not described above.	See Article 3.6		Table 1705.8
	j. Verify proper placement of tremie pipe and use of approved plug to separate concrete from drilling fluid prior to start of concrete placement.	Continuous		Section 1705.8
	k. Perform additional special inspections for concrete used for drilled shafts and LBEs	See Article 3.7		Table 1705.8
	l. Record actual versus theoretical concrete volume placed versus depth during concrete placement. Verify the concrete is overpoured until concrete of good quality reaches the top of the shaft.	Continuous		Section 1705.8
	m. Verify temporary casing is removed and annular space is backfilled in accordance with Contract Documents and approved submittals.	Continuous		Section 1705.8
	n. Verify permanent casing (if used) is cut to correct elevation and latent concrete is chipped and removed down to clean, sound concrete.	Periodic		Table 1705.8
MBTA	o. Completed Drilled Shaft or LBE: At the completion of each element perform the following tasks:	Periodic		
	i. Measure the top of concrete elevation based on survey data provided by the contractor's surveyor.		Technical Specifications	
	ii. Complete an installation form that documents the as-built dimensions and elevations of the drilled shaft/LBE.		Technical Specifications	
	iii. Record the quantity for each pay item at each completed drilled shaft/LBE and verify agreement with the contractor for these quantities.		Technical Specifications	
	iv. Compile and file all inspection records for the completed drilled shaft/LBE.		Technical Specifications	
	v. Update any project control summary tables and charts for drilled shaft/LBE construction		Technical Specifications	
	4. Drilled Micropiles:			
	a. Confirm with the Design Professional in Responsible Charge that static load test results satisfy the requirements of the	Periodic		Section

IBC	Contract Documents prior to commencing installation of production drilled micropiles.			1705.8
	b. Observe, log and maintain a complete and accurate record of each drilled micropile element.	Continuous		Table 1705.8
	i. Verify and record materials, sizes, and lengths for compliance.	Continuous		Section 1705.8

	ii. Observe installation and confirm that drilled micropiles are installed through a fully cased borehole or installed through stable bedrock in an open hole drill hole.	Continuous		Section 1705.8
	iii. Verify and record plumbness, element diameters, permanent casing lengths and sizes, soil/rock strata, quantity/type of obstructions encountered and drilling methods/rates used to penetrate obstructions, bond lengths into bearing strata.	Continuous		Table 1705.8
	iv. Record actual versus theoretical grout volume placed.	Continuous		Section 1705.8
	c. Perform additional special inspections for reinforcement used for drilled micropiles.	See Article 3.6		Table 1705.8
	d. Verify specific gravity of grout prior to placement of each batch.	Periodic	API Recommended Practice 13B-1	Section 1705.8
	e. Record grout volume placed versus depth during grout placement and pressure if pressure grouting methods are used.	Continuous		Section 1705.8
	f. Perform additional special inspections for grout used in drilled micropiles.	See Article 3.7		Table 1705.8
	g. Verify the grout is overpoured until clean neat cement grout reaches the top of the pile. Record post-ground volume(s) placed and pressure when applicable.	Continuous		Section 1705.8
MBTA	h. Completed Drilled Micropile: At the completion of all drilled micropiles in each pile cap, or group of drilled micropiles, perform the following tasks:	Periodic		
	i. Obtain and record the actual top of pile elevation based on contractor's surveyor prior to pile cut off.		Technical Specifications	
	ii. Complete installation forms that document the as-built dimensions and elevations of the drilled micropiles.		Technical Specifications	
	iii. Record the quantity for each pay item at each completed drilled micropile and verify agreement with the contractor for these quantities.		Technical Specifications	
	iv. Compile and file all inspection records for the completed drilled micropiles.		Technical Specifications	
	v. Update any project control summary tables and charts for drilled micropile construction.		Technical Specifications	
	5. Underpinning:			

IBC	a. Verify structural monitoring of the subject structure and/or adjacent structures has been established and is being performed by the contractor, as required by the Contract Documents and/or the Design Professional in Responsible Charge for the approved Submittal prior to, during, and until completion of underpinning work.	As specified by DPRC.		Section 1705.6
-----	---	-----------------------	--	----------------

	b. Verify and record underpinning dimensions, depths, sequence, and excavation support for compliance with approved Contract Documents and Submittals.	Continuous		Section 1705.6 / 1705.8
	c. Subgrades supporting new foundations shall be subject to requirements of Shallow Foundations.	Continuous		Section 1705.6 / 1705.8
	d. Perform additional special inspections for reinforcement and concrete used for underpinning.	See Articles 3.6 and 3.7		Section 1705.6 / 1705.8
	6. Helical Piles:			
IBC	a. Confirm with the Design Professional in Responsible Charge that the static load test results satisfy the requirements of the Contract Documents prior to commencing installation of production helical piles.	Periodic		Section 1705.9
	b. Observe, log and maintain a complete and accurate record of installation operations for each production element.	Continuous		Section 1705.9
	i. Verify installation equipment.	Continuous		Section 1705.9
	ii. Pile lead section and extension dimensions and materials.	Continuous		Section 1705.9
	iii. Final depth and tip elevation.	Continuous		Section 1705.9
	iv. Final torque criterion.	Continuous		Section 1705.9
	v. Other pertinent installation data as required by Designer of Record.	Continuous		Section 1705.9
MBTA	c. Completed Helical Pile: At the completion of installing all helical piles within each pile cap, or group of helical piles, perform the following tasks:	Periodic		
	i. Complete installation forms that document the installation and final torque criterion for the helical piles.		Technical Specifications	
	ii. Record the quantity for each pay item at each completed helical pile and verify agreement with the contractor for these quantities.		Technical Specifications	
	iii. Compile and file all inspection records for the completed helical piles.		Technical Specifications	
	iv. Update any project control summary tables and charts for helical pile construction.		Technical Specifications	

¹ "MBTA" are tests required by the MBTA. "IBC" are tests required by Chpt. 17 of the 2015 International Building Code.

² 2015 International Building Code.

REQ'D BY¹	DESCRIPTION OF TEST OR INSPECTION	FREQUENCY OF TEST OR INSPECTION	REFERENCE STANDARD	IBC REFERENCE²
SPECIAL INSPECTIONS FOR RETAINING WALLS				
	1. Drilled Micropile Walls:			
IBC	a. Monitor installation of Drilled Micropiles in accordance with Table 3.11.4 - Drilled Micropile Foundations.	Continuous		Section 1705.8
	b. Verify placement of drainage board and/or drainage materials behind micropile wall facing and appurtenances in accordance with approved Contract Documents and Submittals.	Periodic		Section 1705.6 / Section 1705.8
	c. Document any unusual or unanticipated conditions observed during drilled micropile wall installation; soil or rock conditions significantly different than those indicated in nearby investigation borings; slow or difficult drilling progress; loss of drilling fluid.	Continuous		Section 1705.6 / Section 1705.8
	d. Perform additional special inspections for reinforcement or steel appurtenant elements used for construction of drilled micropile walls.	See Article 3.6		Table 1705.8
	e. Perform additional special inspections for grout, concrete, or shotcrete materials used for construction of drilled micropile walls.	See Article 3.7		Table 1705.8
MBTA	f. Completed Drilled Micropile Wall: At the completion of drilled micropile wall construction perform the following tasks:	Periodic		
	i. Obtain and record the actual top of pile elevation based on contractor's surveyor prior to pile cut off.		Technical Specifications	
	ii. Complete an installation form that documents the as-built dimensions and elevations of the drilled micropiles.		Technical Specifications	
	iii. Record the quantity for each pay item at each completed wall and verify agreement with the contractor for these quantities.		Technical Specifications	
	iv. Compile and file all inspection records for the completed drilled micropile wall.		Technical Specifications	
	v. Update any project control summary tables and charts for drilled micropile wall construction.		Technical Specifications	
	2. Modular Precast Block Walls:			
	a. Verify that the precast block			

IBC	manufacturing facility is approved by the MBTA. If manufacturing is not performed at an approved precast concrete facility, perform additional special inspections for reinforcement and concrete used for modular precast blocks.	See Article 3.6 and 3.7		Section 1705.3
	b. Verify subgrade below block wall units has been prepared in accordance with the Contract Documents and the approved contractor Submittals.	Continuous		Section 1705.6

	c. Verify excavations have been performed to the required depths and lateral dimensions and have reached the proper materials indicated on the Contract Documents.	Periodic		Section 1705.6
	d. Verify placement of leveling course or leveling pad is at the correct location and elevation prior to setting a block wall unit.	Periodic		Section 1705.6
	e. Verify bottom row of blocks are properly placed and have proper spacing, bracing, batter.	Periodic		Section 1705.6
	f. Verify correct block wall units are being placed (size, shape, depth) with proper number of connections, if applicable, with required set back or batter and non-woven geotextile filter placed over joints where required.	Periodic		Section 1705.6
	g. Verify wall drainage installed in correct locations.	Periodic		Section 1705.6
	h. Prior to delivery to the site and periodically during wall construction perform classification and testing of backfill materials to verify compliance with Contract Documents and approved Submittals.	Periodic	ASTM D6913, ASTM D4318 and ASTM D1557 and other pertinent tests required	Section 1705.6
	i. Verify use of proper materials, lateral limits and loose lift thicknesses during placement, compaction equipment and number of passes during compaction, and dry density and moisture content of compacted fill soils.	See Article 3.10 - Earthwork		Section 1705.6
	j. Verify ancillary items (e.g. catch basins, storm- water piping, guardrail, moment slab) installed in accordance with Contract Documents and approved Submittals.	Periodic		Section 1705.6
MBTA	k. Completed Modular Precast Block Wall: At the completion of wall construction perform the following tasks:	Periodic		
	i. Compile and file all inspection records for the completed modular precast block wall.		Technical Specifications	
	ii. Update any project control summary tables and charts for modular precast block wall construction.		Technical Specifications	
	3. Concrete Diaphragm (Slurry) Walls:			
	a. Observe, log and maintain a complete			Section

IBC	and accurate record of supplemental pre-construction borings where required.	Continuous		n 1705. 8
	b. If required, verify depth of pre-excavation and type of material used to backfill pre-excavation.	Periodic		Section 1705. 8
	c. Verify temporary guide wall locations, sizes and elevations.	Periodic		Section 1705.8
	d. Verify diaphragm wall panel materials, sizes, and lengths for compliance.	Continuous		Table 1705.8
	e. Observe, log and maintain a complete and accurate record of each diaphragm wall panel.	Continuous		Table 1705.8

	f. Verify acceptability of trench stabilization fluids during excavation and prior to concrete placement for compliance.	Periodic	Contract Documents and Approved Contractor Submittals	Section 1705.8
	g. Record placement location, plumbness and elevations, confirm panel widths, record panel lengths, record soil/rock strata, record quantity/type of any obstructions encountered and excavation methods/rates used to penetrate obstructions, and embedment lengths into bearing strata.	Continuous		Section 1705.8
	h. Verify cleanliness of panel element bottom prior to reinforcement placement and immediately prior to concrete placement.	Continuous		Section 1705.8
	i. Reinforcement Cages:			
	i. Verify steel grade, dimensions, arrangement, sizes and spacing.	Periodic		Section 1705.8
	ii. Verify the types, sizes and spacing of centering devices and verify rebar cage bottom spacers ("boots") are installed, if required.	Periodic		Section 1705.8
	iii. Verify other embedded devices are installed as required. Other devices may include knock-out panels or geotechnical instrumentation.	Periodic		Section 1705.8
	iv. Verify splices are performed in accordance with the requirements of the Contract Documents and approved Diaphragm Wall Installation Plan. Note splice lap lengths; the type, size and installation procedure for mechanical splices; and the staggering of the splices.	Periodic		Section 1705.8
	j. Perform additional special inspections for reinforcement used for diaphragm wall construction.	See Article 3.6		Section 1705.8
	k. Verify type and placement of end stops and depth of waterstops during primary panel construction.	Periodic		Section 1705.8
	l. Verify proper placement of tremie pipe and type of plug (pig) to separate concrete from trench stabilization fluid prior to start of concrete placement.	Continuous		Section 1705.8
	m. Perform additional special inspections for concrete used for diaphragm wall construction.	See Article 3.7		Table 1705.8

	n. Record actual versus theoretical concrete volume placed versus depth during concrete placement. Verify the concrete is overpoured until concrete of good quality reaches the top of the diaphragm wall panel.	Continuous		Section 1705. 8
--	--	------------	--	-----------------------

	o. Document any unusual or unanticipated conditions observed during diaphragm wall excavation including: evidence of caving, bottom heave or other signs of trench instability; soil or rock conditions significantly different than those indicated in nearby investigation and supplemental construction borings; slow or difficult excavation progress; loss of trench stabilization fluid; surface settlement or other signs of ground loss around the trench excavation.	Continuous		Section 1705.8
MBTA	p. Completed Diaphragm Wall Panel: At the completion of each diaphragm wall panel perform the following tasks:	Periodic		
	i. Confirm the specified top of concrete elevation based on survey data provided by the contractor's surveyor.		Technical Specifications	
	ii. Complete an installation form that documents the as-built dimensions and elevations of the diaphragm wall panel.		Technical Specifications	
	iii. Record the quantity for each pay item at each completed diaphragm wall panel and verify agreement of the contractor for these quantities.		Technical Specifications	
	iv. Compile and file all inspection records for the completed diaphragm wall panel.		Technical Specifications	
	v. Update any project control summary tables and charts for diaphragm wall panel construction.		Technical Specifications	
	4. Mechanically Stabilized Earth (MSE) Walls:			
IBC	a. Verify that precast block manufacturing facility is approved by the MBTA. If manufacturing is not performed at an approved precast concrete facility, perform additional special inspections for reinforcement and concrete used for MSE wall precast facing panels.	See Articles 3.6 and 3.7		Section 1705.3
	b. Verify MSE subgrade has been prepared in accordance with the Contract Documents and the approved contractor Submittals.	Continuous		Section 1705.6
	c. Verify excavations have been performed to the required depths and lateral dimensions and have reached the proper subgrade materials indicated on the Contract Documents.	Periodic		Section 1705.6
	d. Verify placement of leveling course or leveling pad at correct location and elevation prior to setting MSE wall facing panels.	Periodic		Section 1705.6
	e. Verify bottom row of MSE wall precast facing panels are properly placed and have	Periodic		Section

	proper spacing, bracing, batter.			1705.6
	f. Verify correct MSE wall facing panels are being placed (size, shape, depth) with proper number of connections, if applicable, with required set back or batter and non-woven geotextile filter placed over joints where required.	Periodic		Section 1705.6
	g. Verify wall drainage installed in correct locations.	Periodic		Section 1705.6

	h. Prior to delivery to the site and periodically during wall construction perform classification and testing of backfill materials to verify compliance with Contract Documents and approved Submittals.	Periodic	ASTM D6913, ASTM D4318 and ASTM D1557 and other pertinent tests required	Section 1705.6
	i. Verify type, length, and spacing of reinforcement installed per designer and manufacturer requirements.	Periodic		Section 1705.6
	j. Verify connections made to MSE wall facing panels made in accordance with designer required prior to backfill.	Periodic		Section 1705.6
	k. Verify use of proper materials, lateral limits and loose lift thicknesses during placement, compaction equipment and number of passes during compaction, and dry density and moisture content of compacted fill soils.	See Article 3.10 - Earthwork		Section 1705.6
	l. Verify ancillary items (e.g. catch basins, storm- water piping, guardrail, moment slab) within the MSE wall's reinforced zone are installed in accordance with Contract Documents and approved Submittals.	Periodic		Section 1705.6
MBTA	m. Completed MSE Wall: At the completion of wall construction perform the following tasks:	Periodic		
	i. Compile and file all inspection records for the completed MSE wall.		Technical Specifications	
	ii. Update any project control summary tables and charts for MSE wall construction.		Technical Specifications	
	5. Steel Sheet Pile Walls:			
IBC	a. Observe, log and maintain a complete and accurate record of any supplemental construction phase borings where required.	Continuous		Section 1705.7
	b. Verify sheet pile wall element materials, sizes, and lengths for compliance.	Continuous		Section 1705.7
	c. For sheet pile wall elements with coatings, review and verify coating inspections have been performed by supplier for compliance with Contract Documents and approved Submittals.	Periodic		Section 1705.7
	d. Verify condition and thickness of sheet pile coating (if required) prior to installation, and repair (if required) in accordance with manufacturer requirements.	Periodic		Section 1705.7

	e. If required, verify depth of pre-excavation and type of material used to backfill pre-excavation.	Periodic		Section 1705.7
	f. Observe, log and maintain a complete and accurate record of sheet pile installation.	Continuous		Section 1705.7
	g. Document any unusual or unanticipated conditions observed during installation of sheet piles.	Continuous		Section 1705.7
	h. Record placement location, plumbness, elevations, and minimum embedment lengths required for lateral resistance.	Continuous		Section 1705.7
	i. Verify wall drainage installed in correct locations, where applicable.	Periodic		Section 1705.7

	j. Perform additional special inspections for all welded or bolted connections, special fabrication or appurtenances used for sheet pile wall.	See Article 3.6.		Section 1705.7
	k. Verify type, length, size and spacing of lateral anchor system(s) installed for compliance with Contract Documents and the approved contractor Submittals.	Periodic		Section 1705.7
MBTA	l. Completed Steel Sheet Pile Wall: At the completion of sheet pile wall perform the following tasks:	Periodic		
	i. Complete an installation form that documents the as-built elevations of the sheet piles installed.		Technical Specifications	
	ii. Record the quantity for each pay item and verify agreement with the contractor for these quantities.		Technical Specifications	
	iii. Compile and file all inspection records for the completed sheet pile wall.		Technical Specifications	
	iv. Update any project control summary tables and charts for sheet pile wall construction.		Technical Specifications	
	6. Soldier Pile and Lagging Walls:			
IBC	a. Observe, log and maintain a complete and accurate record of supplemental construction phase borings where required.	Continuous		Section 1705.8
	b. If required, verify depth of pre-excavation and type of material used to backfill pre-excavation.	Periodic		Section 1705.8
	c. Verify soldier pile element materials, sizes, and lengths for compliance with Contract Documents and approved contractor Submittals.	Continuous		Section 1705.8
	d. Observe, log and maintain a complete and accurate record of each soldier pile element installation.	Continuous		Section 1705.8
	e. Verify acceptability of drilling fluids (if applicable) during drilling and prior to concrete placement for compliance.	Periodic	Contract Documents and Approved Contractor Submittals	Section 1705.8
	f. Verify placement location, plumbness and elevations; confirm element diameters; record soldier pile lengths; record soil/rock strata; record quantity/type of obstructions encountered; drilling methods/rates used to penetrate obstructions; minimum embedment lengths into soil strata or bedrock required for lateral resistance.	Continuous		Section 1705.8

	g. Document any unusual or unanticipated conditions observed during soldier pile shaft excavation including: evidence of caving, bottom heave or other signs of hole instability; soil or rock conditions significantly different than those indicated in nearby investigation and supplemental construction borings; slow or difficult drilling progress; loss of drilling fluid; surface settlement or other signs of ground loss around the soldier pile excavation.	Continuous		Section 1705. 8
--	---	------------	--	-----------------------

h. Verify cleanliness of shaft bottom prior to reinforcement placement and immediately prior to concrete placement.	Continuous		Section 1705.8
i. Reinforcement Cages or Embedded Steel Elements:			
i. Verify steel grade, dimensions, arrangement, sizes and spacing.	Periodic		Section 1705.8
ii. For cages, verify the types, sizes and spacing of centering devices and verify rebar cage bottom spacers ("boots") are installed, if required.	Periodic		Section 1705.8
iii. Verify other embedded devices are installed as required. Other devices may include knock out panels or geotechnical instrumentation.	Periodic		Section 1705.8
iv. Verify splices are performed in accordance with the requirements of the Contract Documents and approved Soldier Pile Installation Plan. Note splice lap lengths; the type, size and installation procedure for mechanical splices; and the staggering of the splices.	Periodic		Section 1705.8
v. Perform additional special inspections for reinforcement or steel embedded elements used for soldier piles and lagging.	See Article 3.6		Table 1705.8
j. Verify proper placement of tremie pipe and type of plug (pig) to separate concrete from drilling fluid prior to start of concrete placement.	Continuous		Section 1705.8
k. Perform additional special inspections for concrete and controlled low strength materials used for soldier piles and lagging.	See Article 3.7		Table 1705.8
l. Record concrete volume placed versus depth during concrete placement. Verify the concrete is overpoured to required elevation until concrete of good quality reaches required design elevation. Record placement of void fill material up to top of pile (granular material, controlled density fill or controlled low strength material).	Continuous		Section 1705.8
m. Verify temporary casing removed and annular space backfilled in accordance with Contract Documents and approved Submittals.	Continuous		Section 1705.8
n. Verify soldier pile concrete is chipped and removed down to required design elevation for placement of lagging or clean, sound concrete; whichever is lower. Verify placement of controlled low strength material or grout for leveling pads for precast wall panels.	Periodic		Section 1705.8

	o. Verify placement of drainage board and/or drainage materials behind soldier pile lagging/facing and appurtenances in accordance with Contract Documents and approved Submittals. Confirm drainage aggregates are being kept free of fine materials; composite drainage boards are being placed with the proper side to the seepage face and are continuous for the full height; and collection/outlet pipes have a positive slope.	Periodic		Section 1705.6 / Section 1705.8
	p. Verify placement of precast/prefabricated lagging or construction of cast-in-place facing in accordance with Contract Documents and approved Submittals.	Periodic		Section 1705.8
MBTA	q. Completed Soldier Pile Wall: At the completion of soldier pile wall construction perform the following tasks:	Periodic		
	i. Obtain and record the actual top of pile elevation from contractor's surveyor.		Technical Specifications	
	ii. Complete an installation form that documents the as-built dimensions and elevations of the drilled soldier pile.		Technical Specifications	
	iii. Record the quantity for each pay item at each completed wall and verify agreement with the contractor for these quantities.		Technical Specifications	
	iv. Compile and file all inspection records for the completed drilled soldier pile wall.		Technical Specifications	
	v. Update any project control summary tables and charts for drilled soldier pile wall construction.		Technical Specifications	
	7. Permanent Ground Anchors:			
IBC	a. Verify permanent ground anchor location/elevation, materials, sizes, and lengths for compliance.	Continuous		Section 1705.8
	b. Observe, log and maintain a complete and accurate record of installation of each permanent ground anchor.	Continuous		Section 1705.8
	c. Observe installation and confirm that permanent ground anchors are installed through a fully cased borehole or installed into stable bedrock through an open drill hole, unless stipulated otherwise in the Contract Documents or approved Submittals.	Continuous		Section 1705.8
	d. Verify placement location and inclination; record permanent ground anchor free, bond, and stress lengths; record size of temporary drill casing and			

	drilling tools; record soil/rock strata; record quantity/type of any obstructions encountered, drilling methods/rates used to penetrate obstructions, embedment lengths into design soil/rock strata; and any instrumentation (e.g. strain gages).	Continuous		Section 1705.8
--	--	------------	--	-------------------

	e. Verify condition of anchor tendon assembly prior to use. Repair in accordance with manufacturer's requirements or replace with new anchor assembly if damaged.	Periodic	PTI	Section 1705.8
	f. Perform additional special inspections for steel shapes used for permanent ground anchors.	See Article 3.6		Section 1705.8
	g. Perform additional special inspections for grout used for permanent ground anchors.	See Article 3.7		
	h. Verify specific gravity of grout prior to placement of each batch.	Periodic	API Recommended Practice 13B-1	Section 1705.8
	i. Record grout volume placed during grout placement and pressure, if pressure grouting methods are used. Verify the grout is overpoured until clean, neat grout reaches the head of anchor. Record post-ground volume(s) placed and pressure when applicable.	Continuous		Section 1705.8
	j. Observe, log, and maintain a complete record of testing conducted by contractor to verify ultimate capacity of each permanent ground anchor:	Continuous	Section 8 of PTI DC35.1-14, Contract Documents and Approved Submittals.	Section 1705.8
	i. Performance tests on permanent ground anchors in accordance with the Contract Documents and approved Submittals.			
	ii. Proof tests on permanent ground anchors in accordance with the Contract Documents and approved Submittals.			
	k. Verify permanent ground anchor lock-off and conduct lift-off testing.	Continuous		
	l. Verify finish work of anchor head.	Continuous	Contract Documents and Approved Submittals.	Section 1705.8
MBTA	m. Completed Permanent Ground Anchor: At the completion of each ground anchor perform the following tasks:	Periodic		
	i. Complete installation and testing forms that document the as-built dimensions, successful testing and lock-off of the permanent ground anchors.		Technical Specifications	
	ii. Record the quantity for each pay item and verify agreement with the contractor for these quantities.		Technical Specifications	
	iii. Compile and file all inspection records for the completed permanent ground anchor.		Technical Specifications	

	iv. Update any project control summary tables and charts for permanent ground anchor construction.		Technical Specifications	
	8. Permanent Soil Nail Wall:			
IBC	a. Verify bench excavation elevation and plan location and type, nature, and moisture condition of excavated materials present at the face of excavation prior to soil nail installation.	Periodic		Section 1705.6
	b. Verify soil nail materials, sizes, and lengths for compliance.	Continuous		Section 1705.8

	c. Observe, log and maintain a complete and accurate record of each soil nail.	Continuous		Section 1705.8
	d. Observe installation and confirm that soil nails are installed through a fully cased borehole or installed into stable bedrock through an open drill hole.	Continuous		Section 1705.8
	e. Document any unusual or unanticipated conditions observed during excavation or soil nail wall installation; soil or rock conditions significantly different than those indicated in nearby investigation borings; slow or difficult drilling progress; loss of drilling fluid.	Continuous		Section 1705.6 / 1705.8
	f. Verify placement location and inclination, record soil nail lengths, record size of temporary drill casing and drilling tools, record soil/rock strata, record quantity/type of any obstructions encountered, drilling methods/rates used to penetrate obstructions, embedment lengths into design soil/rock strata.	Continuous		Section 1705.8
	g. Verify condition of soil nail assembly prior to use. Repair in accordance with manufacturer's requirements or replace with new soil nail assembly if damaged.	Periodic		Section 1705.8
	h. Verify specific gravity of grout prior to placement of each batch.	Periodic	API Recommended Practice 13B-1	Section 1705.8
	i. Record grout volume placed during grout placement and pressure, if pressure grouting methods are used. Verify the grout is overpoured until clean neat grout reaches head of soil nail. Record post-ground volume(s) placed and pressure when applicable.	Continuous		Section 1705.8
	j. Observe, log, and maintain a complete record of testing conducted by contractor to verify ultimate bond resistance of soil nails:	Continuous	Section 9.4 of FHWA-NHI-14-007 (FHWA GEC 007) or Section 34.5.5 of AASHTO	Section 1705.8
	i. Verification load test on sacrificial test nail(s).			

	ii. Proof load test on production soil nail.		LRFD Bridge Design Specifications, latest edition, Contract Documents and Approved Submittals.	
	k. Verify placement of drainage board behind initial shotcrete facing in accordance with Contract Documents and approved Submittals. Verify drainage board strips are connected in a continuous manner from the lift above.	Periodic		Section 1705.6 / 1705.8

	l. Perform additional special inspections for reinforcement or steel appurtenant elements used for construction of soil nail walls.	See Article 3.6		Table 1705.8
	m. Perform additional special inspections for grout, concrete, or shotcrete materials used for permanent soil nail walls.	See Article 3.7		Table 1705.8
	n. Verify finish work of soil nail head as required by Contract Documents and approved contractor Submittals.	Periodic		Section 1705.8
MBTA	o. Completed Permanent Soil Nail Wall: At the completion of each soil nail wall perform the following tasks:			
	i. Complete installation and testing forms that document the as-built dimensions of soil nails and successful verification/proof testing of the soil nails.		Technical Specifications	
	ii. Record the quantity for each pay item and verify agreement with the contractor for these quantities.		Technical Specifications	
	iii. Compile and file all inspection records for the completed soil nail wall.		Technical Specifications	
	iv. Update any project control summary tables and charts for soil nail wall construction.		Technical Specifications	
	9. Secant Pile Wall:			
IBC	a. Observe, log and maintain a complete and accurate record of supplemental construction phase borings where required.	Continuous		Section 1705.8
	b. Verify secant pile element materials, sizes, and lengths for compliance with Contract Documents and approved contractor Submittals.	Continuous		Section 1705.8
	c. Observe, log and maintain a complete and accurate record of each secant pile element.	Continuous		Section 1705.8
	d. Verify acceptability of drilling fluids (if applicable) during drilling and prior to concrete placement for compliance.	Periodic	Contract Documents and Approved Contractor Submittals	Section 1705.8
	e. Verify placement location and plumbness and elevations, confirm element diameters, record pile lengths, record soil/rock strata, record quantity/type of obstructions encountered, and drilling methods/rates used to penetrate obstructions,	Continuous		Section 1705.8

	embedment lengths into bearing strata.			
	f. Document any unusual or unanticipated conditions observed during secant pile excavation including, evidence of caving, bottom heave or other signs of hole instability; soil or rock conditions significantly different than those indicated in nearby investigation and supplemental construction borings; slow or difficult drilling progress; loss of drilling fluid; surface settlement or other signs of ground loss around the secant pile excavation.	Continuous		Section 1705. 8

	g. Verify cleanliness of bottom of drill hole prior to reinforcement placement and immediately prior to concrete placement.	Continuous		Section 1705.8
	h. Reinforcement Cages or Embedded Steel Elements:			
	i. Verify steel grade, dimensions, arrangement, sizes and spacing.	Periodic		Section 1705.8
	ii. For cages, verify the types, sizes and spacing centering devices and verify rebar cage bottom spacers ("boots") are installed, if required.	Periodic		Section 1705.8
	iii. Verify other embedded devices are installed as required. Other devices may include knock out panels or geotechnical instrumentation.	Periodic		Section 1705.8
	iv. Verify splices are performed in accordance with the requirements of the Contract Documents and approved Secant Pile Installation Plan. Note splice lap lengths; the type, size and installation procedure for mechanical splices; and the staggering of the splices.	Periodic		Section 1705.8
	i. Perform additional special inspections for reinforcement used for secant piles.	See Article 3.6		Table 1705.8
	j. Verify proper placement of tremie pipe and type of plug (pig) to separate concrete from drilling fluid prior to start of concrete placement.	Continuous		
	k. Perform additional special inspections for concrete used for secant piles.	See Article 3.7		Table 1705.8
	l. Record theoretical versus actual concrete volume placed versus depth during concrete placement. Verify the concrete is overpoured until concrete of good quality reaches the top of the pile.	Continuous		Section 1705.8
MBTA	m. Verify temporary casing removed and annular space backfilled in accordance with Contract Documents and approved Submittals.	Continuous		Section 1705.8
	n. Completed Secant Pile: At the completion of each secant pile perform the following tasks:	Periodic		
	i. Obtain the surveyed final, as-built location of the secant pile and the actual top of concrete elevation		Technical Specifications	
	ii. Complete an installation form that documents the as-built dimensions and elevations of the secant pile.		Technical Specifications	
	iii. Record the quantity for each pay item at each completed secant pile and verify agreement of the contractor for		Technical Specifications	

	these quantities.			
	iv. Compile and file all inspection records for the completed secant pile.		Technical Specifications	
	v. Update any project control summary tables and charts for secant pile construction.		Technical Specifications	

¹ "MBTA" are tests required by the MBTA. "IBC" are tests required by Chpt. 17 of the 2015 International Building Code.

² 2015 International Building Code.

<u>REQ'D BY¹</u>	<u>DESCRIPTION OF TEST OR INSPECTION</u>	<u>FREQUENCY OF TEST OR INSPECTION</u>	<u>REFERENCE STANDARD</u>	<u>IBC REFERENCE²</u>
SPECIAL INSPECTIONS FOR GROUND IMPROVEMENT				
IBC	1. Special inspections with documentation shall be continuous during all construction activities related to ground improvement including, but not limited to, materials, load testing, element installation, element cut-offs, subgrade preparation, load transfer pads and any fill placed between elements and footing bottoms.	Continuous		1809.14
IBC	2. Confirm that the results of pre-production ground improvement element test results satisfy the requirements of the Contract Documents and approved Contractor Submittals prior to commencing installation of production ground improvement elements.	Continuous		1809.14
	3. Jet Grouting:			
IBC	a. Observe, log and maintain a complete and accurate record of supplemental construction phase borings where required.	Continuous		1809.14
	b. Observe pre-production jet grouting test program installed at approved location near the planned production work and in representative soils and depths anticipated to be encountered during production work.	Continuous		1809.14
	c. Review critical parameters established during the test program to verify test columns meet required design criteria.			
	i. Critical parameters include: type of jet- grouting (single, double or triple), necessity of pre-jetting with water, grout mix composition, fluid(s) flows and pressures, rotational speed, lift rate, spoil return, grout, and number and size of nozzles, as well as in situ soil-cement column properties, verticality, and dimensions.	Continuous		1809.14
	ii. Critical in situ soil-cement column properties to record will vary based on the design intent but may include column location, plumbness, diameter, compressive strength, uniformity, or other characteristics required to achieve design performance.	Continuous		1809.14
	iii. Verify production jet grout elements meet the parameters established during the test program and the required design criteria.	Continuous		1809.14
	d. During the test program and production			

	jet grouting, observe, log and maintain a complete and accurate record of each jet grout column. Record soil strata, record quantity/type of obstructions encountered, methods/rates used to penetrate obstructions, minimum embedment lengths into soil strata required.	Continuous		1809.14
--	---	------------	--	---------

e. Measure unit weight of spoil for each soil strata undergoing jet grouting at each test and production column location. Verify spoil unit weight from production columns meets required value for each primary, secondary, and closure columns to verify column density, as well as overlap and closure requirements.	Periodic		1809.14
f. Where jet grout elements are incorporated in a cutoff wall with bottom seal, observe pumping test conducted to determine the hydraulic effectiveness of the overall system.	Continuous		
g. Review daily reports produced by the jet grouting specialty contractor. Daily reports shall include the following:	Periodic		1809.14
i. Equipment and personnel on site.			
ii. Work initiated and completed.			
iii. Production interruptions.			
iv. Grouting records.			
v. Jet grout element number, size, and location.			
vi. Time and date of beginning and completion of each grout element, including interruptions to the jetting process or material supply.			
vii. Grout mix data, including mix proportions and unit weight density measurements.			
viii. Injection pressure of all fluids used to construct each grout element.			
ix. Flow rates of all fluids used to construct each grout element.			
x. Rotation rate and lift rate of jet rods for each grout element.			
xi. Total grout quantity used for each element.			
xii. Top and bottom elevations of the jet grout element.			
xiii. Whether flow of spoils return was continuous.			
xiv. Total quantities of materials used for that day.			
xv. Observations of any unusual, or unanticipated conditions including obstructions, stoppages, loss of circulation, etc., impacts on instrumentation or monitoring.			
xvi. Applicable verification testing done.			
h. Perform additional special inspections for reinforcement or steel appurtenant	See Article		1809.14

	elements used for construction of jet grout columns/walls.	3.6		
MBTA	i. Completed Jet Grout Installation: At the completion of jet grout installation perform the following tasks:	Periodic		1809.14
	i. Obtain the surveyed final, as-built location and top elevation of the jet grout columns.		Technical Specifications	

	ii. Complete an installation form that documents the as-built dimensions and elevations of the jet grout columns.		Technical Specifications	
	iii. If payment for jet grouting is based on unit pricing, determine the quantity for each pay item at each completed wall and verify agreement with the Contractor for these quantities.		Technical Specifications	
	iv. Compile and file all inspection records for the completed jet grout installation.		Technical Specifications	
	v. Update any project control summary tables and charts for jet grouting construction.		Technical Specifications	
	4. Rammed Aggregate Piers:			
IBC	a. Observe, log and maintain a complete and accurate record of supplemental construction phase borings where required.	Continuous		1809.14
	b. Verify contractor has established and maintains layout and elevations of proposed footings/structures to be supported and proposed aggregate piers.	Periodic		1809.14
	c. Observe installation of modulus test piers and uplift load test piers and perform monitoring of modulus and uplift load tests. Verify results of modulus and uplift tests meet design requirements.	Continuous		1809.14
	d. For replacement-method aggregate piers, verify pier excavations extend to the required depths and lateral dimensions and have reached the proper materials indicated on the Contract Documents. Record observations of any unusual, or unanticipated conditions including obstructions, stoppages, and impacts on instrumentation or monitoring.	Continuous		1809.14
	e. Observe Contractor perform bottom stabilization testing (BSTA) at base of required number of piers. Verify BSTA results indicate displacement values meet criteria in approved contractor Submittals.	Continuous		1809.14
	f. For test and production piers, verify aggregate base construction and shaft construction, including aggregate type, lift thicknesses, and compactive effort per lift, meet project requirements.	Continuous		1809.14
	g. Verify tops of aggregate piers are not disturbed after final densification of top lift and prior to placement of load transfer pad and overlying footing/structure.	Periodic		1809.14
	h. Verify placement of load transfer pad			

	at correct location, elevation, using materials and compaction to required density per project requirements.	Continuous		1809.14
	i. Review Contractor's Daily Reports. Daily Reports should include:	Periodic		1809.14
	i. Footing and pier location.			

	ii. Pier length and drilled diameter.			
	iii. Planned and actual pier elevations at the top and bottom of the element.			
	iv. The number of lifts and time of tamping for each lift placed.			
	v. Average lift thickness for each pier.			
	vi. Documentation of soil conditions during drilling for comparison with soil conditions in boring logs.			
	vii. Depth to groundwater, if encountered.			
	viii. Documentation of any unusual conditions encountered (e.g., sloughing).			
	ix. Type and size of densification equipment used.			
	x. Applicable verification testing done.			
	j. Perform additional special inspections for reinforcement or steel appurtenant elements used in aggregate piers to resist uplift.	See Article 3.6		1809.14
	k. Perform additional special inspections for grout used in rammed aggregate piers.	See Article 3.7		1809.14
	l. Observe in-situ verification testing of soils reinforced by aggregate columns.	Continuous		
MBTA	m. Completed Piers: At the completion of finished aggregate piers, perform the following tasks:			
	i. Record the quantity for each pay item at each completed ground improvement element and verify agreement with the contractor for these quantities.		Technical Specifications	
	ii. Compile and file all inspection records for the completed aggregate piers.		Technical Specifications	
	iii. Update any project control summary tables and charts for aggregate pier construction.		Technical Specifications	
	5. Rigid Inclusions:			
IBC	a. Observe, log and maintain a complete and accurate record of supplemental construction phase borings where required.	Continuous		1809.14
	b. Verify contractor has established and maintains layout and elevations of proposed footings / structures to be supported and proposed rigid inclusions.	Periodic		1809.14
	c. Verify rigid inclusion element materials, sizes, and lengths for compliance.	Continuous		1809.14
	d. Observe, log and maintain a complete and accurate record of each rigid inclusion	Continuous		1809.14

	element.			
	e. Observe installation and confirm that rigid inclusions are installed in a manner consistent with project requirements that maintains integrity and diameter of element throughout its length. Record observations of any unusual, or unanticipated conditions including obstructions, stoppages, impacts on instrumentation or monitoring.	Continuous		1809.14

f. Verify placement location and plumbness, confirm element diameters, record element lengths, record permanent casing lengths and sizes (if used), record soil/rock strata, record quantity/type of any obstructions encountered, drilling methods/rates used to penetrate obstructions, embedment lengths into bearing strata.	Continuous		1809.14
g. Perform additional special inspections for steel reinforcement used for rigid inclusions.	See Article 3.6		1809.14
h. Perform additional special inspections for concrete or grout used for rigid inclusions.	See Article 3.7		1809.14
i. Verify specific gravity of grout prior to placement of each batch.	Periodic	API Recommended Practice 13B-1	1809.14
i. Record grout/concrete volume placed versus depth during grout placement and pressure if pressure grouting methods are used. Verify the grout is overpoured until clean neat grout reaches the top of the rigid inclusion. Record post-ground volume(s) placed and pressure when applicable.	Continuous		1809.14
j. Confirm with the Design Professional in Responsible Charge that static load test results satisfy the requirements of the Contract Documents prior to commencing installation of production rigid inclusions.	Periodic		1809.14
k. Completed rigid inclusion: At the completion of each day of rigid inclusion installation, perform the following tasks:	Periodic		1809.14
i. Obtain the surveyed final, as-built location of the rigid inclusions and the actual top of rigid inclusion elevation.			
ii. Complete installation forms that document the as-built dimensions and elevations of the rigid inclusions.			
iii. If payment for rigid inclusions is based on unit pricing, determine the quantity for each pay item at each completed rigid inclusion and verify agreement of the contractor for these quantities.			
iv. Compile and file all inspection records for the completed rigid inclusions.			
v. Update any project control summary tables and charts for rigid inclusion construction.			
l. Verify tops of rigid inclusions are not disturbed prior to placement of load transfer pad and overlying footing/structure.	Periodic		1809.14

	m. Verify placement of load transfer pad at correct location, elevation, using materials and to required density per project requirements.	Periodic		1809.14
	n. Review Contractor's Daily Reports. Daily Reports should include:	Periodic		1809.14
	i. Footing and pier location.			
	ii. Element length and drilled diameter.			

	iii. Planned and actual element elevations at the top and bottom of the element.			
	iv. Documentation of soil conditions during drilling for comparison with soil conditions in boring logs.			
	v. Depth to groundwater, if encountered.			
	vi. Documentation of any unusual conditions encountered (e.g., sloughing).			
	vii. Type and size of concrete vibration equipment used.			
	viii. Applicable verification testing done.			
MBTA	o. Completed Piers: At the completion of all rigid inclusions within a specified area indicated on the Contract Documents, perform the following tasks:	Periodic		
	i. Obtain the surveyed final, as-built location and the top of pier elevations.		Technical Specifications	
	ii. If payment for rigid inclusions is based on unit pricing, determine the quantity for each pay item at each completed wall and verify agreement of the contractor for these quantities.		Technical Specifications	
	iii. Compile and file all inspection records for the completed rigid inclusions.		Technical Specifications	
	iv. Update any project control summary tables and charts for rigid inclusion construction.		Technical Specifications	

¹ "MBTA" are tests required by the MBTA. "IBC" are tests required by Chpt. 17 of the 2015 International Building Code.

² 2015 International Building Code.

REQ'D BY¹	<u>DESCRIPTION OF TEST OR INSPECTION</u>	<u>FREQUENCY OF TEST OR INSPECTION</u>	<u>REFERENCED STANDARD</u>	<u>IBC REFERENCE</u>²
SPECIAL INSPECTIONS FOR GEOSYNTHETICS				
IBC	1. Verify material properties upon delivery and proper storage by the contractor.	Periodic	Approved Contractor Submittals and Manufacturer Requirements.	Section 1705.6
IBC	2. Verify subgrade has been properly prepared prior to placement of geosynthetics.	Continuous		Section 1705.6
IBC	3. Verify placement of geosynthetic including but not limited to anchor trenches, temporary ballasting, or additional length for connections for conformance.	Periodic	Contract Documents and Approved Contractor Submittals.	Section 1705.6
IBC	4. Verify (as applicable) minimum required overlap between adjacent sections of geosynthetic placed, penetrations, or field seaming for conformance.	Periodic	Contract Documents and Approved Contractor Submittals.	Section 1705.6
IBC	5. Verify repairs to any damaged sections are performed in accordance with manufacturer's recommendations.	Periodic	Contract Documents, Approved Contractor Submittals, and Manufacturer Requirements.	Section 1705.6
	6. Geotextiles:			
IBC	a. If manufactured material properties are different in two orthogonal directions, confirm that the geotextile is installed in the correct orientation.	Periodic	Contract Documents, Approved Contractor Submittals, and Manufacturer Requirements.	Section 1705.6
MBTA	b. Compile and file all inspection records for installed geotextiles. Work may be observed and documented as an incidental activity to earthwork, foundation, or retaining wall construction.		Technical Specifications	
	7. Geomembranes:			

IBC	a. Verify Contractor Construction Quality Control (CQC) plan for geomembranes accepted by Design Professional in Responsible Charge prior to start of construction.	Periodic	i. GRI Test Method GM9, "Standard Practice for Cold Weather Seaming of Geomembranes" ii. EPA / 530 / SW-91 / 051, "Inspection Techniques for Fabrication of Geomembrane Field Seams" iii. EPA / 600 / R-93 / 182, "Quality Assurance and Quality Control for Waste Containment Facilities"	Section 1705.6
	b. Verify contractor performs required quality control test at specified frequencies and satisfactory repairs made, if required.	Continuous		Section 1705.6
MBTA	c. Compile and file all inspection records for installed geomembranes and quality control test reports by Contractor.	Periodic	Technical Specifications	

¹ "MBTA" are tests required by the MBTA. "IBC" are tests required by Chpt. 17 of the 2015 International Building Code.

² 2015 International Building Code.